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August 1982
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Number 68

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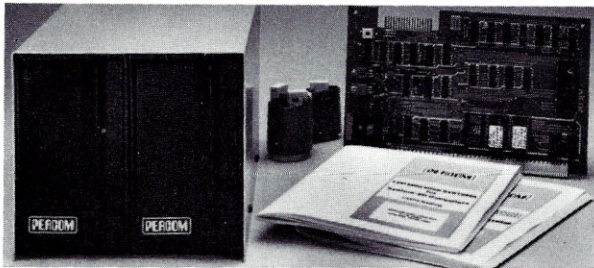
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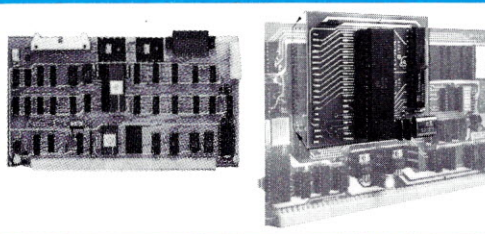


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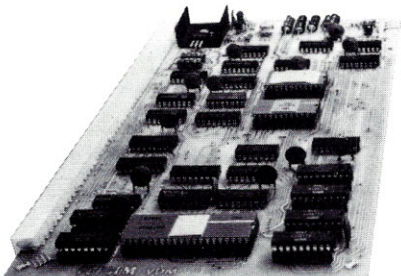
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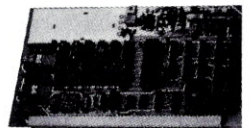
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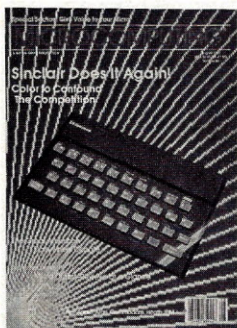
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MICROCOMPUTING

On the cover: From the man who gave us the first pocket calculator and the first pocket television, as well as the ZX80 and ZX81 micros, comes the Spectrum color computer. The system, which features 16K, improved graphics and a truly "expanded" Basic—all at a low-cost Sinclair price, will be available later this year in the U.S. for about \$270 (\$375 for 48K). Our English correspondent, Fernleigh Edmondson, broke all speed records in providing us with this first look (p. 76) of the Spectrum, which promises to give other color micros a run for their money. The cover photos by Edmondson show the Spectrum and a sample graphics display.

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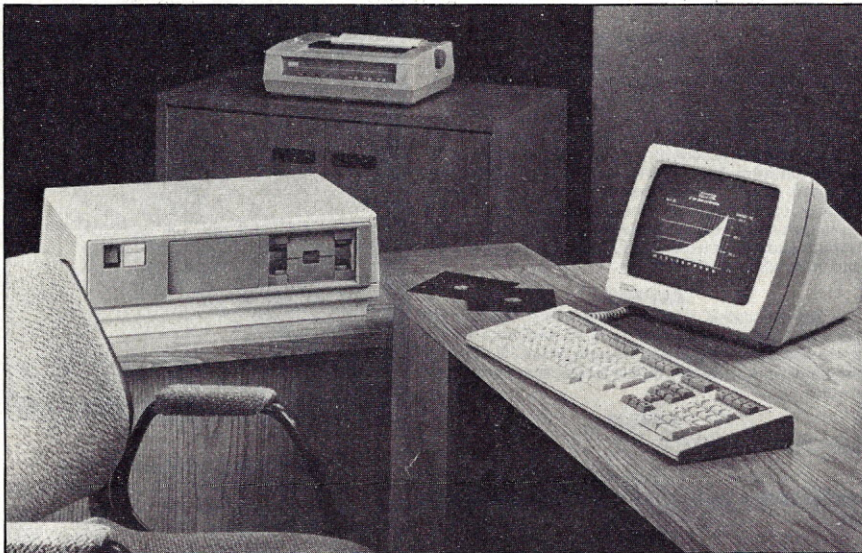
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DEC Unwraps Micro Package

Four Newcomers Join the Celebration



New from DEC—the Rainbow 100.

DEC Arrives

A few days ago I got an invitation to come to Boston for a celebration of DEC's 25 years in the computer business. The invitation was not further explicit, but since they were offering a free lunch I was unable to keep myself from driving down to see what was up.

The big deal was the unveiling of four microcomputer systems by DEC. They've waited an incredibly long time to come into the field, but now that they are here they have quite a wide product range. All of the systems look identical, with the differences being inside. The range of prices are surprisingly narrow too, running from \$3500 to \$5000.

There was some mention of color, but none was shown. The monitor for all four systems was a very lightweight tube that could be placed almost anywhere. The keyboard for all systems was identical, and worked with a simple wire connected to the CPU unit. This allows the keyboard to be used just about anywhere. The board, which is very thin, but rather

long, was surprisingly heavy, so it should stay in place as you type on it. The keyboard has plenty of keys for word processing and special functions, as well as a numerical keypad.

The least expensive unit, the Rainbow 100, seems to be aimed at the IBM niche, with its Z-80 and 8088 processors. The Decmate II, the latest incarnation of the good old PDP-8A, now available in micro form, has a 12-bit processor that uses all the PDP-8A software that has been developing since around 1965. The two more expensive systems were PDP-11 oriented, allowing the use of that software.

Since DEC seems to be run like a group of firms producing different products, the announcement of four different microcomputers was not surprising. When rumors of DEC micros were first heard, people wondered how DEC could ever get their several divisions together to put out one micro. The answer was simple: each group put out their own computer, all using the same keyboard, monitor and CPU cabinet.

While this solves the internal problems for DEC, it does leave a lot of problems for

the marketing people. How are they going to explain the differences to the prospective customers? This may turn out to be one of the biggest marketing jobs yet—or it may turn out to be impossible.

The systems look good. The prices are reasonable. Now let's see what happens.

The Key to Wealth

Normally I write most of my chit-chat editorials for *73 Magazine*, often wandering off into anything which interests me. In this case, the following is not really geared to the ham readership.

One of the nice things about the United States is that just about anyone who really wants to can get rich. It has little to do with luck, brains, education or any of the other usual excuses we use to keep from feeling bad about being a failure in life. You don't have to be crooked, though at times I'm hard put to see where that has made much difference in some cases.

We're all on the same merry-go-round together, spinning around once a day. The difference is that just a few people have the guts to reach out and grab the ring as it goes by. It's there and *any* of us could make the grab for it.

Of course, we are playing life's crap game with the dice loaded against us. The "system" is set up to guarantee failure for almost everyone. Perhaps it is fortunate that there are only a few whistle-blowers like me. You know, I think I get the most kick of anything when people come up to me at shows and tell me how some of my past editorials have gotten them to start thinking in terms of making money, and they have succeeded. There is plenty of room for several thousand more multimillionaires, if you are willing to grab for the ring.

The truly successful people often as not have not been to college at all. College seems to offer a slight advantage to graduates for a while, but this is illusory.

The really bad side of college is that for the most part the whole exercise is aimed at providing you with a job in a large cor-

poration. Now that's something no one in his right mind should ever take. Talk about a dead end! Even if you are able to survive the politics of the large company, you'll never make any real money, not millions.

Worse, large firms are very much like the military in that the people with the initiative and ideas are considered trouble-makers and are kept from advancement. In the military you do *not* create waves, not even in the Navy. The result of this is that the chiefs of staff are people who have come up through the ranks of officers, never causing trouble and thus getting no black marks on their records. So who do we have running our military establishment? We have the people who have never caused any trouble—exactly the wrong people for the job.

The same goes for most large corporations. There is a natural filter to sift out everyone with ideas and push, shunting them aside into dead-end jobs where they can't cause trouble. So, when you see some incredibly dumb decisions by corporate leaders, remember how most of them got where they are: by not ever rocking the boat.

Worse, when you work for a large firm the odds are heavily against your learning anything of real value to you if the time ever comes when you want to reach for that golden ring and get out of the rat race. Most of the jobs in large firms are so narrow in the work done that you end up with little of the experience you need to make a small business succeed. And small business, at least in our country, is where the gold is.

One of the reasons I'm working on trying to get a pilot model college started is to provide the type of education that I think a college really ought to have. Further, my kind of college is geared to the needs of the world at this time—to provide both a technical training and an entrepreneurial education. Further, it is planned so that students will get three types of education: theory, lab and practical.

A typical work day would start with 2½ hours in the classroom working with theory. Then there would be 2½ hours of work in a lab, putting the theory into practical terms and using it. This would be followed by five hours working in an on-campus business as a trainee doing professional work. The income from this work would cut the costs of the education to perhaps one third normal, making up for the cuts in federal supports.

This college would not be aimed at providing cannon fodder for giant corporations, but would spew out thousands of eager-beaver entrepreneurs who would soon be starting thousands of new small businesses...and flourishing. Large firms would do well to hire these graduates on as prospective CEOs (chief executive officers), but how many of the Fortune 1000 firms have shown any signs of

being perceptive?

You don't have to wait for me to get a college going to start taking advantage of the opportunities we have in this country. There are just too many money-making opportunities waiting for you right now. Oh, you will have to do your homework before you lay out your life's savings on a gamble. You surely don't want to try and learn what you need to know to make a business succeed on your own money, do you? That's stupid, not adventurous.

No, you want to get the background you need—not available from any college I've heard of, or from working for large firms (or the military)—by working for a small business. You don't learn to be a plumber by working in a law office, right? No, it should be obvious that if

you want to learn about running a small business, you damned well should work for one.

Yes, I know, you can't initially make as much with a small business as you can with a corporate giant. If making a bit more up front is worth selling your soul for, the devil is there, waiting for you. Ask any college senior about the interviewing teams which visit the schools shortly before graduation. Suckers.

With each new major computer system being introduced to the market there is an opportunity for hundreds of small businesses to start up and grow. Look at the business that has built up around the TRS-80! There are over a thousand small firms providing programs and accessories for this system. And the market is far from saturated.

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If you can come up with the product, we have the magazines that will bring you together with the customers. From there on it is a matter of how clever you are at advertising, production and keeping up with the market as it constantly changes and grows.

Unemployment

Comparing the latest unemployment statistics with those of the past is hardly a fair comparison when one considers the enormous changes in other conditions.

For instance, the unemployment figures of the 1930s reflected many entirely different circumstances. In those days the average household had one wage earner, so the impact of unemployment was far more immediate and direct than today. World War II changed our work patterns, bringing women out of the home and into jobs previously held almost entirely by men. Then, with the end of the war, women found they liked the

With one or more
new computers entering
the market each week,
there is just no end
to the ways for small firms
to get started and grow.

income and the freedom this gave them and stayed working.

It took no time at all for the market to adjust to the two-income family, suitably raising the prices of everything to reflect this increased buying power. This made it so one-income families were at a serious disadvantage, forcing more women to go to work, or else having to make do with less.

There was one other major change made: minimum wage laws. This law, put through and rigidly supported by unions, forced employers to get rid of marginally productive people and replace them with machines as fast as possible. The result of this was to make it exceedingly difficult for unskilled people, particularly teenagers entering the work place, to get work.

Since most teenagers are living at home with two other wage earners, the need for a minimum wage is questionable. Any additional income is beneficial. Of course, we can look at the bright side and see that if very many teenagers were permitted to work, their income, when added to the two wages of the family, would tend to further drive up prices since most of it would be extra money over and above subsistence.

When one looks more questioningly at the unemployment statistics, one finds that only 6 percent of married men are out of work. Further, 40 percent of the unemployed are out of work less than four weeks, and the median is about 8½ weeks. One other factor is self-inflicted unemployment, which should perhaps be considered separately from the problems of people who have been laid off. Forty percent of those looking for work quit their last jobs or are entering the labor force anew. And one-sixth of the unemployed are only looking for part-time work.

One other perspective: about half of the families with someone unemployed still have an income of \$20,000 or more.

To firms in the microcomputing industry this whole unemployment business is weird. Here we have firms who are absolutely desperate for good people—sometimes at any salary—but can't seem to find them. Yet the papers are full of unemployment headlines.

Germany has a government system

that matches people with available jobs country-wide. We do have a lot of employment agencies and even a government unemployment system, but it is strictly regional, so worker needs in New Hampshire are not passed on to New York. My firm needs writers, editors, salesmen, data processing people, technicians, printers and so on, but in New Hampshire there are about 25 jobs for every available person, so we can't find the people.

Perhaps some firm can set up a national computerized job bulletin board to tackle this problem.

At any rate, when you read those "disaster" articles in the paper, take 'em with a grain of salt. There is no honest reason to compare unemployment statistics of 1982 with those of 1932. It's a completely different world today and, painful as unemployment is in some areas, if the people would move, they would find jobs.

Computer Design

There have been far too few articles on the design of microcomputers. I'm sure there are still a few hobbyists who are experimenting with some new ideas. So let's see some articles on your work to get others thinking. Remember that it is primarily hobbyists, not manufacturers, who come up with innovative designs.

Publishing can protect you patentwise if you come up with something unique, while at the same time advertising your idea so that manufacturers can see it and bid for it. □

MICRO QUIZ

Assembly-Language Programming

After the following program is executed, what value will be stored at TMP?

X	DC	-5
Y	DC	-3
START	LOAD	Y
	ADD	Y
	ADD	Y
	STORE	3Y
	LOAD	X
	ADD	X
	SUB	3Y
	BL	ELSE
	ADD	3Y
	BU	DONE
ELSE	LOAD	X
	ADD	Y
	ADD	Y
DONE	STORE	TMP
	END	

(answer on page 140)

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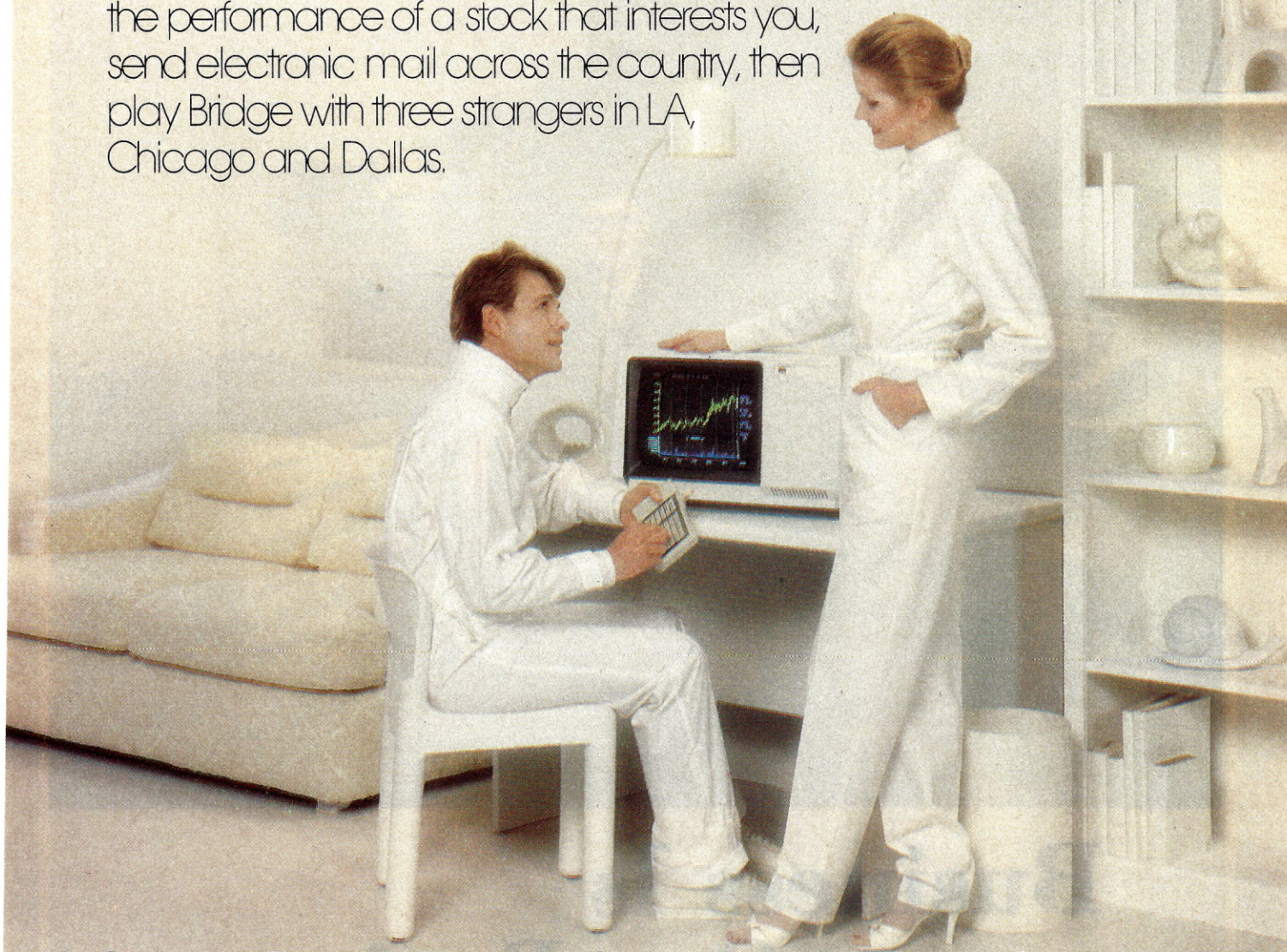
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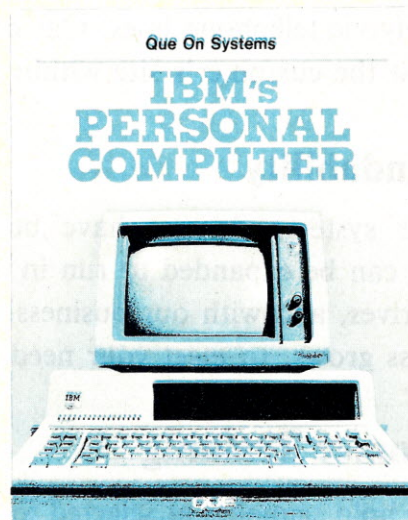
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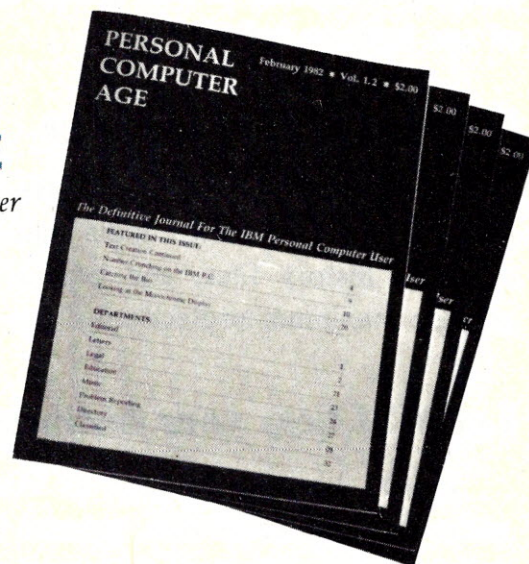
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Useful Utilities For VIC, PET/CBM

Count, Catalog, Communicate With HES

Human Engineered Software (3748 Inglewood Blvd. Room 11, Los Angeles, CA 90066) has been building a reputation for high-quality, well-documented programs for Commodore systems. Their list of available programs is growing constantly and now includes several programs for the VIC-20 as well as the PET and CBM models. I recently tried their Hescount, Hescat and Hescom programs and found them extremely useful utilities.

Hescount

Hescount is a simple utility program that counts the number of times individual lines of a Basic program are executed. These counts can then be used to optimize program execution or to debug. Lines with high counts quickly point out places where optimization techniques will be most highly rewarded. Lines that are never executed can point out possible errors in your program logic. They may also contain undetected syntax errors and should be checked.

Hescount is a machine-language program, roughly 700 bytes long, that resides at the top of memory in your PET or VIC and monitors the execution of Basic programs. When you first load in a Basic program to be analyzed, it is not in a form that Hescount can use. Therefore, Hescount is called once to set up the Basic program to be analyzed. Now you can run your program, stopping and continuing as desired.

When the program is finished running, you then call Hescount a second time to restore the Basic program to its original form and to extract the counts obtained while running. The actual counts are formatted into a two-dimensional array, UQ%, that contains the line numbers and execution counts.

When your program is in the Hescount format you should not edit or change any lines in the program. If you do, then that line will run OK, but it will not participate in the counting. Also, when Hescount is executed the second time, all lines, ex-

cept those that were modified while the program was in the Hescount format, will be returned to the normal format for a Basic program. Hescount format means that every line has four bytes added to the end of it—:REMxx—where the colon and the REM token each take one byte while xx represents two bytes used for the counts for that line.

Hescount normally counts the number of times the first statement of a Basic program line is executed, with one exception. When a single line contains a FOR followed by a NEXT with at least one intervening instruction, Hescount will count the number of times the instruction following the FOR is used. If a line of this type were counted only once, then even if that loop executed many times and caused major degradation of performance, it would not stand out in the counts.

The counting algorithm does lead to one condition where executed instructions are undercounted. Instructions that follow a FOR on a line are not counted as many times as they are executed. However, with one rare exception, some part of the loop will be counted correctly. You just have to be sure to examine all the lines of a FOR-NEXT loop. Misrepresentation might occur when there is an IF following FOR on the same line and there are multiple exits from the loop.

Hescount automatically creates the UQ% array used to store the counts when called the second time. The UQ% array containing the counts is created after your Basic program runs, so if your program should contain a UQ% array it will not be interfered with during the program. At the end of the run, your UQ% will be overwritten by the counts Hescount creates.

After creating the UQ% array, the counts are available through direct commands or possibly through code already in your Basic program. Since the line numbers and counts are put into an array, you have great flexibility on how you

handle the counts. You can sort it based on decreasing counts so that the most executed lines stand out, you can save it on disk or tape for later analyzing, you can plot it, or you can just print it out on the screen or printer. Sample programs are included to help give you ideas on ways to use the data created.

Remember that the counts created by Hescount are cumulative between the two calls to Hescount. Neither RUN nor CLR resets the counts. The maximum count that can be stored by Hescount is 65024. The line counter stops when it reaches that value even if the line is executed more times.

Hescount comes with versions for the VIC, all PET/CBM ROMs (2-3-4) and a demo program on tape for \$23.95. The program automatically adjusts itself for any memory size. The documentation package includes over 30 pages with commented source listings for the assembly code.

Hescat

Hescat is a powerful and easy to use disk cataloging system. It's similar to my Disk Master program (see June 1982 *Microcomputing*, p. 56) but has a few new features and runs much faster. Hescat has five main functions, each supported by a separate Basic program. Some programs also contain machine-language subroutines wherever extra execution speed is necessary.

With Hescat you can easily maintain a catalog of all your disks. You can then keep a sorted file that contains all filenames from all disks which you can then search to find a complete or partial filename. You can examine information about all your disks or just certain selections. If you have a printer, you can also

Address correspondence to Robert W. Baker, 15 Windsor Drive, Atco, NJ 08004.

print out a short list of summary information about each disk, a complete list of all files separated by the disk they are on, or you can print one long list with all the files sorted alphabetically.

The programs work on any PET/CBM with Basic 3.0 or 4.0 and at least 16K of memory (32K is recommended). You must, however, have one of the dual disk Commodore disk units—2040, 4040 or 8050. On a 2040/4040 drive you can catalog from 3300 to 6000 or more filenames from 134 disks. On an 8050 disk you can catalog from 10,000 to over 20,000 filenames from 214 disks. Quite impressive!

The Hescat disk must always be inserted in drive 0 when being run. Drive 1 is used for disks that are being cataloged or for scratch disks used for certain sort functions.

The Hescat programs will add and delete various files on the Hescat disk as they execute; you should not put any other files onto this diskette. All Hescat programs are menu-driven with extensive error handling and extremely good "human engineering." Each of the programs in the package is loaded and run via the main Hescat program itself.

The Catalog program does the actual cataloging or uncataloging of disks from the master directory. It requires that each of your disks be assigned a unique two-character external label or ID. This external ID does not have to be the same as the internal ID assigned when a disk is formatted via the New or Header command. The use of an external disk ID allows you to catalog two or more disks with identical header names or internal IDs.

The Catalog program creates a file on the Hescat disk with the same name as the external ID of the disk that is being cataloged. It also maintains a headers file that contains summary information for all disks currently cataloged. The entire cataloging process is extremely fast, usually taking only a few seconds.

The Sort Names program creates a file containing every filename you have cataloged, sorted alphabetically. It also indicates what type of file it is (Program, Sequential, User or Relative) and what disk it is on.

The Print program is used to print reports on a printer. Instructions are included for simple changes that allow using an Epson MX-80 or Base-2 printer instead of a Commodore printer.

The Display program permits you to look at certain Hescat files on the screen.

The Locate program is used to quickly find a full or partial filename in the alphabetized file created by Sort Names. The searching is done in machine language and is extremely fast. It can search through 1700 filenames in about one second.

The main Hescat menu even provides a user function with which you can add your own functions if desired. The added

PDT ASSEMBLER.DOC

PRB BLACK FRIDAY
PRB BOWLING AVERAGE
PRB BOWLING GAME
PRB BUDGET/DISK
PRB BUDGET/TAPE

PTT CATALOG
PRB COMPACTOR
PTT COPYCAT

PRB DASM ASSEMBLER
PDT DASM ASSEMBLER
PDT DASM EDITOR
PRB DASM EDITOR
PRB DASM LOADER
PDT DASM LOADER
PDT DASM/TASM.DOC
PRB DASM2 ASSEMBLER
PRB DASM2 EDITOR
PRB DATA COMPARE
PRB DATE BOOK
PVT DIR
PRB DISASSEMBLER
PRB DISK DISPLAY
PRB DISK LISTER
PRB DISK MASTER/4040
PRB DISK MASTER/8050
PRB DISK MASTER/BOTH
PDT DISK-TAPE COPY
PRB DISK-TAPE COPY
PTT DISPLAY
STT DT
PRB DUPE CHECK

PDT EDITOR.DOC

STT HEADERS
PTT HESCAT
PRB HOUSE INV/DISK
PRB HOUSE INV/TAPE

PRB LINE EDITOR/3.0
PTT LOCATE

PDT MISC.DOC

PVT NEW DIR
PVT NEW DISPLAY T&S

PRB PGM DATA/DISK
PRB PGM DATA/TAPE
PRB PGM SEARCH/DISK
PRB PGM SEARCH/TAPE
PTT PRINT

STT RB

SDT SAMPLE.LST
SDT SAMPLE.SRC
PTT SORT NAMES
PDT SPACE SAVER
SDT SPACE SAVER.LST
SDT SPACE SAVER.OBJ
SDT SPACE SAVER.SRC
PRB SYMBOL LIST

PRB TAPE HEX DUMP
PRB TAPE-DISK COPY
PDT TAPE-DISK COPY
PDT TASM ASSEMBLER
PRB TASM ASSEMBLER
PRB TASM EDITOR
PDT TASM EDITOR
PRB TASM LOADER
PDT TASM LOADER
PDT TASM NOLIST ASEM
PRB TASM NOLIST ASM
PVT TEST DATA
PRB TIME BILLING

PRB UNCOMPACTOR

PVT VITERM A
STT VT

PRB WAS RECORDS
PRB WIND CHILL
PRB WORD HUNT
PRB WP CONVERTER
PRB WP DISK PRINT
PRB WP PRINTER
PRB WP TAPE PRINT

PRB XREF (16K) / 3.0
PRB XREF (16K) / 4.0
PRB XREF (32K) / 3.0
PRB XREF (32K) / 4.0
PRB XREF / 8016
PRB XREF / 8032

Sample Hescat output showing full alphabetical listing of all files cataloged.

function can either be additional code within the Hescat program or another program loaded and run by the Hescat program.

Hescat is only distributed on disk and sells for \$39.95. Documentation is extensive, with over 50 pages and full program listings. There are even source code listings for all machine-language

routines. Complete descriptions are provided for each program with a list of all variables used and their function. You'll even find full descriptions of file layouts for all files created by Hescat and hints on how to modify the Hescat programs if desired. This is really one super utility package for any Commodore owner with a disk!

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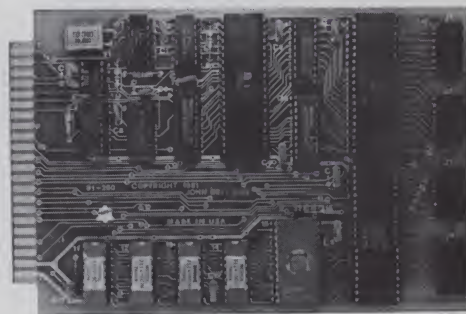
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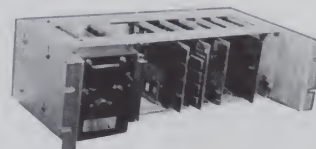
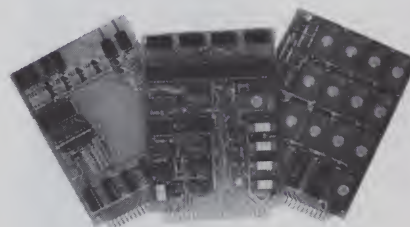
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Hescom

Hescom is an extremely interesting machine-language utility program that provides communications between any two Commodore PET or VIC systems. The communications is done via the user ports of the two machines with a special cable connecting them together. Basically there are two classes of operations available, latched and unlatched.

In the latched mode, commands are available to send or receive a block of memory or to send a program to the other computer. The unlatched mode allows real-time applications, such as two machine games.

When communicating in the latched mode, special handshaking is used to ensure reliable data transfers. This requires that a copy of Hescom be loaded and running in each system. Each byte transferred is held on the user port (latched) until it has been received and acknowledged by the Hescom program in the other computer.

The actual transfer rate is around 7000 bytes per second. That's about 140 times faster than the tape drive and more than three times as fast as the 2040 disk drive. It only takes half a second to transfer a 3.5K program to a VIC-20 using Hescom.

Whenever Hescom is not actually running, the Hescom port is in an unlatched mode. Therefore, you can make use of the unlatched mode without involving the Hescom program itself. To use the unlatched mode, you simply set the port to either input or output and then either read or write the port. In this mode the data on the port reflects the contents of the connecting port at that very instant.

A demo program is included to help acquaint you with the operation of Hescom and to check out that the cable is functioning properly. The demo program works on either a PET or a VIC and allows you to display on one machine the contents of memory in the other machine. You can even transfer the program itself and try it from the other end as well.

There are only two special things to watch out for when using Hescom; both are related to interrupts. The first involves the interrupt flag (the VIA IFR), which must never remain set when it is not supposed to be set. If the Hescom cable is plugged in, and either one of the computers is powered on, the IFR will most probably get set on one or both systems. Normally, when you power on the computer and then load Hescom, there will be no problem, since the program makes sure the IFR is reset before running.

However, sooner or later you will turn off one machine, so you must know how to clear the IFR. It's really quite simple—just one peek to the right location corrects the situation. If left uncorrected, Hescom responds as though the other computer wanted to start a data transfer.

The other cause of problems is the stop key, which can also cause the IFR to be set indirectly. Hescom normally checks the stop key whenever it is waiting for something and will exit correctly if it has been hit. However, none of this changes the fact that the IFR has been set on and you have to do the peek to clear the condition.

This program presents unlimited uses for the really imaginative. If you have a PET and a VIC, you could set up the VIC as a terminal to the PET. The unlatched mode allows real-time sampling of data sent from the other machine. This permits simple conversions for existing games into two-machine, two-player games. You could also use the VIC as a high-resolution color display for the PET, for sound or even to get input from joysticks or paddles. Just think about what you could do with a PET controlling your VIC-20!

The Hescom program is supplied with separate versions for the VIC and PET ROMs 3 and 4, the demo program, complete documentation and a five-foot connecting cable for \$49.95. Custom cables up to 25 feet long can be specially ordered. As usual, the 35 or so pages of documentation are excellent and extremely well written.

Commodore News

Information about the new systems from Commodore is still slow to surface. The new 40-column system with 128K of RAM is now referred to as the Commodore "P" series (PET II), being the third generation of the popular PET computer. It is designed for use with a separate color monitor or TV (via a built-in rf modulator) and has 16 colors available for text or graphics.

The Commodore "B" series (CBM II) is the second generation of the CBM business computers. This system offers 128K of RAM and features an attached display and integral disk units.

The 16-bit multiprocessor CBM professional computer is the new Commodore "BX" series. This is an enhanced version of the Commodore "B" series and offers 256K of RAM and two processors, a 6509 and a 16-bit 8088.

The "P" and "B" series micros accommodate a second processor, which is standard in the "BX," to create a multiprocessor system. A Z-80 processor board that offers CP/M compatibility and an 8088 16-bit board that offers CP/M-86 compatibility will be available initially.

The new systems are all expandable to 512K of RAM. They all include new versions of Basic with additional new commands and support for up to 256K of program space. The new Basic is supposed to be backwards compatible with the older versions of Commodore Basic.

Don't forget, the new systems all utilize the new 6509 microprocessor. No data sheets or exact information were available at this writing, but I was told it

will be software compatible with the older 6502. The only difference will be that the 6509 will use locations 0 and 1 for specific extended addressing capabilities.

Location 0 is the execution register and is used for all instruction fetches. Location 1 is the indirect register and is used for all indirect addressing. The lower four bits of each byte will be used to select one of 16 available 64K banks of memory space. This will extend the addressing capabilities of the 6509, allowing it to directly address one megabyte of address space.

The previously announced Ultimex system is now being called the Commodore "Max" Machine and the suggested retail price has been increased to \$179.95. This system will only contain 256 bytes of RAM and no internal ROM.

Several new games for the VIC-20, including Gorf, Omega Race and Sargon II Chess, along with the Home Babysitter, Personal Finance and Visible Solar System cartridges, made their debut at the Summer Consumer Electronics Show (CES) in June.

Educational Software

Special Learning Ed Software (PO Box 16322, Minneapolis, MN 55416) is offering a set of educational programs for computer-based instructional activities in spelling. The programs are designed for students with specific language disabilities but are of value to students of all learning levels. There are 24 tapes covering five basic spelling rules essential to encode words. They are priced at \$38 to \$57 in groups of four to six tapes. The entire series on tape or disk is only \$199. The programs are said to work on any 40-column PET.

K-12 Micro Media (172 Broadway, Woodcliff, NJ 07675) is distributing a catalog listing over 125 educational PET programs by Micrograms, Inc. Their programs are intended for use by children in kindergarten through sixth grade. The primary goal of each program is to promote student learning and mastery of the subject material. Careful attention was given to creating programs in which structural design, graphics and sound contribute effectively to keeping students interested in the subject matter.

All of the programs are designed to run on 40-column PETs with full-size keyboards and are available on cassette or 8050 disk. Subject matter covers reading skills, mathematics, language, spelling, science and social studies. For teacher aids, a grader and test tabulator are also available. Prices start at \$9.95 for a single program and range to \$189.95 for any combination of 24 programs.

Misc

Optimized Data Systems (PO Box 595, Placentia, CA 92670) recently announced their new PH-003 Disk-O-Mate

for the Commodore 2040/4040 disk drive. The Disk-O-Mate includes write-protect switches and indicators for each drive, a power-on indicator and audible error beeper. The switches and indicators are mounted in a small (2 x 3 x 1) control box that can be placed on the disk unit or near the computer.

The control box connects by a cable to a circuit board that "piggy backs" onto an internal connector in the 2040/4040 disk. Installation involves simple reconnection of internal disk unit cables, without special tools or skills or any soldering. Full instructions are said to be provided. Price is in the \$70 to \$80 range and the unit is shipped fully assembled and tested.

Transonic Laboratories (249 Norton St., Mankato, MN 56001) has enhanced their ROM Detective program for the VIC-20. It's now written in machine language instead of Basic and a few new features have been added. You can now do hex, decimal and ASCII dumps of memory, hex to decimal or decimal to hex conversions, and you can search memory for a specific word. The price is still the same—\$4.95 on tape. Write them for more information on this and other VIC-20 software at low cost.

A new independent newsletter called *Strictly Commodore* has surfaced for VIC, PET and CBM owners. Each issue will contain software reviews, informative articles, new product information, programming tips, programs of all types, and more. Almost half of each issue will consist of practical, useful and entertaining programs for Commodore systems. One-year subscriptions for the monthly newsletter are \$18 in the U.S. and Canada, \$27 elsewhere. Inquiries should be addressed to: *Strictly Commodore*, 47 Coachwood Place, Calgary, Alberta, Canada T3H 1E1.

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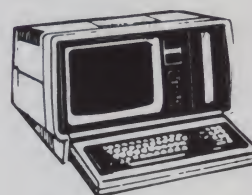
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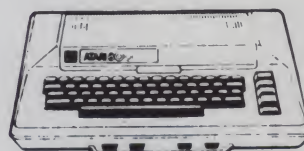
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Microcomputing, August 1982 17

Transend Makes Sense for Apple

Will It Be A New Standard For the Industry?

Welcome to Dial-up Directory. If you have an interest in using your microcomputer as a data communications terminal to communicate with a local electronic message system or a communications utility such as The Source or CompuServe, this column is for you. This month, we will review a communications program for the Apple II microcomputer called Transend. But first, a commercial message and the incoming mail.

My Books

Here is the commercial message. My first book, *Microcomputer Data Communications Systems*, released by Prentice-Hall last December, has been very well accepted. It covers communications technical material, software and hardware for many different kinds of microcomputers including the Apple II, PET, CP/M machines, H-89 and others. Since the TRS-80 is so popular, we thought a separate book on that machine would be justified.

My second book, *TRS-80 Data Communications Systems*, has just been released by Prentice-Hall and covers the entire TRS-80 family of machines. If you are interested in using a TRS-80 as a terminal or as a message system, I believe you will find this book useful. Contact the Microcomputing Book Nook at 800-258-5473 or check your local book store or computer store to get your copy.

Mail Bag

I note that The Source has established a dial-in WATS line for their customers. This might be particularly useful for those users who are not near a Telenet or Tymnet entry point. There is one small rub. They add a surcharge of 25 cents a minute to the usage fee.

If you use The Source during periods of high telephone rates and have to dial a distant carrier entry point, this service might be useful to you. However, as a rule, non-prime users will not benefit from the WATS service. The surcharge for the Source WATS service (25 cents a

minute/\$15 an hour) is less expensive during the day, and more expensive during evenings, nights and weekends, than making an out-of-state call of several hundred miles.

Low-Cost Modems

The low-cost modem race continues. Leading Edge Products, 225 Turnpike St. Canton, MA 02021, is selling the Signalman Mark I modem for around \$120. It is a 300 baud modem with automatic originate/answer selection capability. The price even includes a built-in RS-232-C cable, so you save a few bucks there, too. I haven't used one yet, but I'll give you a full review when I do.

Similarly, Universal Data Systems has released the UDS 212LP for the very low list price of \$495. This is a 1200 baud modem that operates in the Bell 212 standard. It does not, however, have the 300-baud-type 103 operation included in most 212 modems. That's fine with most of us who have 103 modems available (or can buy one for under \$130). Universal Data Systems has been in the modem business for a long time. I'm glad they took this initiative and hope to have one for a full review soon.

Sports Database

I have said before that the information utilities will find better audiences for specialized databases than for general-interest features. The Dow Jones Information Service has added a special-interest database with general-interest appeal. They have begun a sports database.

A user can select between NFL football, major league baseball, college football, NBA basketball, NHL hockey, soccer, golf and tennis. The information is updated by United Press International every weekday morning.

Smart Terminal Software

Transend, marketed by SSM Microcomputer Products, 2190 Paragon Drive, San Jose, CA 95131, serves as a good example of a smart terminal program. It is

designed for the Apple II, but the discussion of its features will bring out capabilities and limitations that apply to programs running on many different microcomputers.

It is always important to note what hardware a smart terminal program requires and what optional hardware it will support. Transend requires an Apple II with 48K RAM and Applesoft or an Apple II Plus with 48K. The system must be equipped with at least one disk, DOS 3.3 (only), and either a serial interface or a bus-decoding modem. Table 1 lists the various I/O cards and devices Transend works with.

Transend has a number of options I like. First, it does the basic things you would expect any smart terminal program to do:

- serves as an on-line terminal
- captures received data
- transmits files
- interfaces with a printer
- auto-dials an integrated modem

Second, Transend does the things you expect a high-quality smart terminal program to do:

- allows review of the capture buffer
- allows the capture buffer to be opened or closed from on-line
- allows the printer to be toggled off and on from on-line
- allows changing between full and half duplex from on-line
- provides customized parameter sets for various information utilities or message systems
- provides single key transmission of short pre-stored messages

Finally, Transend provides capabilities found only in a few other communications packages:

- file compression and expansion
- protocol file transfer (CRC 16)
- redefined character set

Address correspondence to Frank J. Derfler, Jr., PO Box 691, Herndon, VA 22070.

COMMUNICATE!

"The Professional" Series from SDS

NEW Apple II terminal software

- Z-Term "The Professional"™ by Bill Blue, for Apple CP/M*
- P-Term "The Professional"™ by Joel Kunin and Bill Blue, for Apple Pascal**
- ASCII Express "The Professional"™ by Mark Robbins and Bill Blue, for Apple DOS**

Businessmen

Q. Do you have difficulty operating your printer when connected to a time-sharing computer? Are files you're trying to download too large for your system buffer? Does your host computer lose data when you send files to it?

A. "The Professionals" incorporate printer ring buffers which allow slower printers to accept data at their own rates. Very large files are easily received by periodically saving the buffer to disk. Unlike some software which can lose data during disk saves, "The Professionals" not only direct the host to stop, but actually wait for it to respond before performing the save. After a successful save, the host is automatically directed to continue. This process may be repeated indefinitely. Lost data during send is virtually eliminated by the widest variety of send options available in any communications software. "The Professionals" ensure fast, reliable data transfer of any valuable business information.

Authors

Q. Does your line of work involve sending written material to others? Are you a program author who would like to send work in progress to a partner or client and know that it arrived intact? What would the ability to instantly send material or programs to anyone at any time be worth to you?

A. "The Professionals" provide the ideal way to send your articles, manuscripts, reports, programs and technical documents to another computer with phone line access. Now you can work WHEREVER you want, and be assured that your data is sent to its destination quickly and error-free. In fact, compared to the fastest mail services, "The Professionals" offer immediate delivery and will save you the purchase price in just a few uses.

Students

Q. Are you bothered by limited access to your school's existing terminals? Would you like to be able to do your school assignments at home at your own convenience?

A. "The Professionals" allow you to access virtually any dial-up school or college computer system over standard telephone lines. This means no more waiting in line for an available terminal or hassles with malfunctioning school equipment. You can even prepare term papers or reports while off-line and send the completed work to the school computer for final printing. Best of all, you can work from home at the times most convenient for you.

Time Share Users

Q. Are you tired of wasting time and money sending or receiving files with inadequate, poorly designed software? Do you find yourself manually performing the same lengthy log-in procedures over and over again? Would you like to automate these procedures for yourself and others?

A. "The Professionals" allow you to send files which have been prepared in advance. They may then be transferred at any time, as quickly as possible — even to several different systems. No time is wasted reviewing information while on line; data may be captured by your computer or printer (or both) to be evaluated later at your convenience. These features assure minimum on-line time and therefore minimum on-line cost.

"The Professionals" introduce macros that are more sophisticated than anything previously seen in communications software. These "hand-shaking" macros allow you to perform complete multi-stage log-on sequences automatically; all you do is specify the system to be called. This eliminates sign-on errors and greatly simplifies operation of the entire system, not only for you, but for other less skilled operators.

Bulletin Boards

Q. Would you like to be able to take advantage of the information featured on local bulletin boards and information services such as The Source, CompuServe, Dow Jones, and others?

A. "The Professionals" open the world of modem communication networks to you. There are already thousands of these systems and networks in use nationwide. "The Professionals" provide an ideal way of accessing these systems. All 80 column boards, external terminals (even the 40 column screen), and currently available communications devices are fully supported, including the Hayes Micromodem II and Novation Apple CAT. All standard baud rates — 110, 300, 1200 and others — are fully supported; BAUDOT too, if your computer is equipped with the Apple CAT modem.

Clubs

Q. Are there other Apple owners with whom you would like to exchange programs or files, but have been unable to do so because of limitations imposed by the software you now use?

A. Any two Apples equipped with "The Professionals" can transfer ANY type or size file with complete error checking and correction. All of "The Professional" packages are fully conversant with each other and operate almost identically. For the first time ever, you can transfer compatible files to an operating system different from yours — error free!

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Functions of Smart Terminal Software

I am going to pause to define some of the terms listed above for the benefit of those readers who may not be familiar with the functions of smart terminal software.

The first list of features is essentially a "must have" checklist for smart terminal programs. The software must, of course, allow the microcomputer serving as a terminal to operate from the on-line mode. It must also provide the ability to capture the incoming data into a buffer for transfer to disk files. Some programs allow the received file to be transferred to disk in pieces so the system can transfer programs or files larger than the available buffer space.

Finally, a smart terminal program should allow the transmission of files from the local disk out the modem port. An adequate program should provide for "prompted" transmission in which the user can specify a prompt to be received from the host system. This prompt initiates transmission of the next line of text or data. The interface with a printer should include a separate small buffer.

Often, printers print more slowly than the data is being received. They may also lose characters while performing mechanical motions such as a carriage return and line feed. The printer buffer al-

lows the printer to catch up with the received data.

The auto-dial ability refers to a function that will auto-dial phone numbers when an integrated modem is installed or when a "smart" modem such as the Hayes Smartmodem or the Radio Shack Modem II is being used. This feature has come to be accepted as standard on smart terminal programs. Usually, the program will present a list of numbers to be dialed and then dial when the desired number is selected.

The second list of features includes mainly "user friendly" options that make operating more efficient and pleasant. The ability to view the contents of the capture buffer is very useful when the system is being used for electronic mail. The ability to review the received mail simplifies the process of writing a reply.

Being able to open and close the capture buffer allows an initial kind of rough editing. Menus received from the host systems and transmission commands can be eliminated from inclusion in the buffer. The ability to toggle the printer off and on permits this same kind of rough editing on paper.

The value of customized parameter sets is often underestimated by software authors. This feature allows the user to set transmission parameters such as transmission speed, word length, parity,

and echo/no echo once, save them, and use them again. It also usually lets the user pre-store frequently needed short messages such as log-on codes or passwords. As an operating convenience, these short messages can be sent by toggling one or two keys while the user is on-line with a host.

The last list of features can be found on very few smart terminal programs. File compression/expansion and protocol file transfer require that Transend be used by both the transmitting and the receiving systems. File compression/expansion is a technique used to save transmission time. The program will remove and mark multiple characters and, if specified, spaces. The mark used will be shorter than the ASCII character, thereby gaining storage space and transmission time. Of course, the file must be expanded on the other end to make it readable.

Protocol file transmission allows the transfer of files using error checking techniques. A numeric value, derived from the number of 1's in the ASCII text, is assigned to a block of data by the transmitting machine. The receiving system recomputes the number. If the two don't check, the block is retransmitted. There are several different protocol file transfer routines. They vary in the way the check is computed, the size of the block and the messages exchanged.

The ability to redefine characters is particularly useful with a machine like an Apple II that has a limited keyboard. If certain characters are needed (for example, a backslash, which is a cancel sign on many large host systems), a seldom-used key can be redefined to transmit that character. Similarly, characters coming into your system (particularly control codes) can be redefined into characters you can use.

Transend Critique

Now that we have defined our terms, let's see how well Transend performs those functions.

The program does well as an on-line terminal, in auto-dial, and in the interface with a printer. In data capture, it will page the captured data to a disk file as it is received.

The capture buffer can be up to 19K in a 64K machine. The total buffer space available is allocated by the user between capture buffer and print buffer.

The Transend program allows for prompted transmission and for "throttling" the transmission throughput speed. Many message systems (particularly those using Apple II computers as hosts) "pack strings" when receiving data. This takes a finite period of time. They allow for this by transmitting a prompt when they are ready for the next line.

Transend allows for defining this prompt, so data will not be lost when working with one of these systems. Similarly, certain transmission media, such

Serial Printer Interfaces

SSM AIO	California Computer Systems 7710
SSM AIO-II	Apple High Speed Serial
SSM ASIO	Apple Communication Card

Parallel Printer Interfaces

SSM AIO	California Computer Systems 7720/7728
SSM AIO-II	Apple Parallel/Centronics Card
SSM APIO	Apple Silentype Printer Interface
Epson Printer Card	

Modems

Universal Data Systems 202LP (1200 baud)
Hayes Micromodem
Hayes Smartmodem
Novation CAT
Novation Apple CAT
Any 103, 202, 212 compatible modem

Modem Interfaces

SSM AIO
SSM AIO-II
SSM ASIO
California Computer Systems 7710
Apple Communication Card

80 Column Video Cards

M&R SUP'R' Terminal
Smarterm
Videx Videoterm

Table 1. Transend supported interfaces—printer, modem and 80-column cards.

as Telenet, Tymnet and satellite links, may have delays that prevent full speed transmission. A degree of control over the throughput of the system (often known as a "flow" control) is often provided by smart terminal programs to prevent data loss.

Transend provides three methods of throttling—it will wait for and check returned echoes, put nulls after characters or wait for a specified period of time between character transmissions.

Transend does well on the other lists of features, too. A number of useful options are available from on-line. I wish the buffer could be reviewed from on-line, but you have to go through several menus to see it. Up to eight parameter sets, which are called from a menu, can be defined. The parameter sets include a phone number for auto-dialing if an appropriate integrated modem is available. The re-definition function allows the entire keyboard and/or received character set to be changed.

In the final list of features, the Transend file expansion/compression function can provide a savings of up to 20 percent (depending on the kind of material) in transmission time. A special feature even predicts the transmission time for a specified file.

The protocol file transfer program works well and provides good feedback to the user. It does not appear to be compati-

ble with any other file transfer program on the market or in the public domain such as the most commonly used modem series.

Transend will transfer text (T), binary (B), integer (I) and floating point Apple-soft (A) files. The new types of files, S, new A and new B, cannot be transferred.

Transend Adventure

Transend has one design feature that will create frustration in any experienced user. It has a rigid system of menus which insist on leading the user by the hand. The manual lists 89 menus. Some, of course, are only used at initial setup, but the program requires the user to work through multiple menus for any function. This is very time consuming and, if you make one bad choice, you can be off on an adventure.

I demonstrated this program at a local computer club meeting and several club members provided helpful hints during the demonstration such as: "drop the bird," "pick up the key" and other phrases from the Scott Adams Adventure series. SSM provides a thick manual with a glossary and an index of menus, but it isn't easy to use when you know what you want to do, but you aren't sure what choices will eventually lead you there.

SSM should, as a minimum, provide a menu map which shows a user where he

or she is and how to get to another function with a minimum number of steps. Ideally, they should provide a "go" command to allow the user to jump over menus. This would lower the frustration level of experienced users.

SSM Marketing

Transend is marketed in two (soon to be three) levels. Transend 1 provides the basic capabilities including file compression, modem dialing and printer interface. It sells for \$89. Transend 2 includes the features of Transend 1 and adds the protocol file transfer and a few other features. It sells for \$149. Transend 3 is a future release which will include unattended operation and electronic mail functions.

The protocol file transfer capability of Transend 2 makes it useful for users of DOS 3.3. SSM has made many recent changes in this program and present owners of Transend 2 should check with them for an update. Transend 3 has the potential for becoming a new standard for system capability. We look forward to its release.

Release Me

If you have products for microcomputer data communications you would like to tell the world about, drop me a line. Send electronic mail to TCB967 on The Source, or 70003,455 on CompuServe. □

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NOW—A COMPLETE CP/M PASCAL—FOR ONLY—

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Signature _____

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* CP/M is a Digital Research trademark. A 52K CP/M system is required.

LETTERS TO THE EDITOR

Pascal and Basic Square Off Continued

I enjoyed the article "Basic and Pascal Square Off" (by John Sommer, *Microcomputing*, April 1982, p. 140) very much. However, it left me wondering to myself, "What kind of Basic are these people used to?" I have a North Star Horizon and I use Basic most of the time so I decided to run the benchmark programs on my computer. Here are my results:

Benchmark (1) .8 Sec.
Benchmark (2) 5 Sec.
Benchmark (3) 13.5 Sec.
Benchmark (4) 16 Sec.
Benchmark (5) 17 Sec.

Benchmark (6) 24 Sec.
Benchmark (7) 36 Sec.

Sommer's last statement in the article praising Microsoft's Compiled Basic nearly knocked me flat after seeing the results of my tests on North Star Basic—275 seconds for Microsoft, 36 seconds for North Star on test number 7. Give me a break. I don't know if he didn't know about North Star Basic or if he just chose not to test it, but either way you have to admit it sure gives Pascal a run for its money.

James A. Whitman
Ft. Ashby, WV

Reply:

I have received a number of letters

about my article "Basic and Pascal Square Off." I have compiled the timing information sent with these letters along with additional runs that I made on the Xerox 820 and the IBM PC. (See Table 1.) The last name of each contributor is indicated with his submission.

All of the times that were presented in the article were based on K=10,000, while the original benchmarks used K=1000. Some readers initially missed that important point in the article and just ran the benchmarks as repeated from the original article. Mr. Whitman apparently was one who used the K=1000 value, as his times were about ten to one faster than Mr. Cage's times with his North Star, for example. In most cases, the letters I received indicated the K value as shown in the table.

One reader indicated that it may have been appropriate to have specified K as an integer in Basic as was done for the Pascal programs. Another indicated that a change from K=1000 to 10,000 would not end up as a ten to one speed difference. These are two valid points to consider. It is interesting to see that this makes quite a difference in the times for the CBAS-2 runs while it is almost insignificant for the IBM PC Microsoft Basic version. As for the change in loop length, the only change in the IBM PC is attributed to round-off error. For the TRS Color and the CBAS-2 versions, the variations seem acceptably small.

John Sommer
Silver Spring, MD

Test Number	1	2	3	4	5	6	7
Xerox 820							
CBAS-2 V2.08							
K=10000 Float Pt.	69						1573.2
K=10000 Integer	22.4						861.5
K=1000 Float Pt.	7.4						153
K=1000 Integer	n/a						87.2
(Sommer)							
Sinclair ZX-80							
ROM Basic							
K=1000	4.6	6.8	16.2	15.7	18.5	49.6	68.5
(McCormack)							
North Star							
North Star Basic							
K=1000 (?)	.8	5	13.5	16	17	24	36
(Whitman)							
North Star Z80 4Mhz							
MBASIC 5.03							
K=10000 Float Pt.	11.6	40.2	113	112	118	210	347
(Cage)							
North Star Z80 4Mhz							
Tiny Pascal by							
Supersoft - no GOTO							
or WRITELN							
(Cage)	1	1.1	9.4	7.6	8.5	12.6	13.7
Atari 800							
MBASIC							
K=10000 Float Pt.	10	68	127	146	155	245	383
(Baer)							
SWTP 6800							
BASIC							
K=1000							14
(Taylor)							
TRS Color Computer							
6809 @ 1Mhz							
K=1000 Float Pt.	2.3	11.8	22.4	24.3	27.6	42.7	62.3
K=10000 Float Pt.	21.9	129	235.7	253	284.6	436	632.1
IBM P.C.							
MBASIC							
K=1000	1	5	12	12	14	22	36
(Friedman)							
IBM P.C.							
MBASIC							
K=1000 Float Pt.							37
K=1000 Integer							36
K=10000 Float Pt.							369
K=10000 Integer							359
(Sommer)							

Table 1. Timing information compiled from readers' letters and additional runs made by John Sommer on the Xerox 820 and IBM PC.

Solving Power Problems

Congratulations on the excellent article in the May issue of *Microcomputing*, "A Shocking Look At Voltage Suppressors" by G. Michael Vose (p. 72). This whole area of electrical power is too often passed off as "not a problem." I shudder when I hear a computer salesperson say, "Our hardware will operate in any normal office environment." I can assure you that after seven years of working with a very large-scale system the normal office environment is the worst place for any computer.

Over the years we found that installation of a dedicated circuit, with a third wire isolated ground (not conduit ground) was the best solution. In many cases installation of an isolation transformer was required. In certain areas the grounded antistatic mats were required.

As you indicated in your article, each office can be a different problem. One of the most aggravating problems we encountered was in a new building that was constructed "for tenants with computers."

A few suggestions:

- Before you install a computer, take the time to use a power line disturbance analyzer. I recommend that this analysis be run for at least one week, and two weeks if at all possible.
- Know your neighbors. Watch out for automotive shops, machine shops, beauty shops and other heavy users of electrical power.
- Install a dedicated power line, with an isolated third wire ground. Use Bryant 5362IG or Hubbell IG 5362 outlets. All power circuits should come from the same phase of the service drop. Be sure that isolated terminals, if you have any, have their own dedicated circuits.
- Avoid carpet, even the antistatic type.
- Never use extension cords except in an emergency. Be sure the cord is the 3 wire type and in good condition. Replace extension cords with permanent wiring as soon as possible.

- Check daily to see that no other devices are attached to your computer power line circuits.

- If you think you have a power problem, you are probably right. Good clues are blanking screens, flashing or dimming of the CRT displays, or office lights that dim or flicker.

We are long overdue an evaluation of the many devices now on the market that would solve our power problems. I would appreciate knowing if anyone knows of reports or evaluations on these devices.

It appears that the device to clean up electrical power and transient interference problems may soon cost more than the computer.

Donald A. Jackson
Novato, CA

Comments on the Centronics 739

Thanks for your foresight in beginning your new review series on printers in the

May issue with the Centronics 739 (by Jim Hansen, p. 40). Now, after reading the article, I feel comfortable about the investment I made.

Hansen is absolutely right about the printer manual—it is "...one of the worst features...and is definitely not written with the end user in mind." While the computer store salesperson provided me with simple programs to change print styles, the ability to activate extended print, underlining, etc., remained a mystery. It was not until I translated Hansen's program to my Apple that I was able to achieve predictable success. Even the local Centronics sales office personnel were non-specific, although they did provide me with a demo disk which assured me that my printer was capable of outputting the specified features.

So, a big thank you. As a novice in this technology, new and exciting to the common man, I find your magazine very instructive and helpful. Although I'm busy now applying utility programs to accommodate my present needs, I'm looking forward to the exhilarations and frustrations of composing my own programs. And then I will be able to integrate my Centronics printer.

William W. Sabol
Fremont, CA

```
10 REM SHELL SORT TEST
20 DIM A(500)
30 CLS: PRINT "SHELL SORT":PRINT
40 INPUT "How many numbers (2-500)";NN
50 IF NN<2 OR NN>500 THEN END
60 FOR I = 1 TO NN
70 A(I)=RND(1)*NN
80 NEXT I
90 PRINT "Start ";TIME$:START=TIME:D=NN:FLAG=0
100 D=INT((D+1)/2)
110 FOR N=1 TO NN-D
120 IF A(N)<= A(N+D) THEN GOTO 150
130 T=A(N):A(N)=A(N+D):A(N+D)=T
140 FLAG=1
150 NEXT N
160 IF FLAG=1 THEN FLAG=0:GOTO 110
170 IF D>1 THEN GOTO 100
180 PRINT "Finish ";TIME$:FINISH=TIME
190 REM
200 REM
210 ANS=FINISH-START:ANS=INT(ANS/60)
220 PRINT "Time ";ANS;"Secs":PRINT
230 GOTO 40
```

```
10 REM SHELL SORT TEST
20 DIM A(500)
30 ? " ":PRINT "SHELL SORT":PRINT
40 ? "How many numbers (2-500)";INPUT NN
50 IF NN<2 OR NN>500 THEN END
60 FOR I=1 TO NN
70 A(I)=RND(1)*NN
80 NEXT I
90 PRINT "Start NOW":D=NN:FLAG=0
100 D=INT((D+1)/2)
110 FOR N=1 TO NN-D
120 IF A(N)<=A(N+D) THEN GOTO 150
130 T=A(N):A(N)=A(N+D):A(N+D)=T
140 FLAG=1
150 NEXT N
160 IF FLAG=1 THEN FLAG=0:GOTO 110
170 IF D>1 THEN GOTO 100
180 PRINT "Finish NOW"
230 GOTO 40
```

Listing 1. Atari Shell sort. Atari Microsoft Basic is above; Atari 8K Basic is below.

Atari Owners, Rejoice!

In your June issue (Letters to the Editor, p. 22), Martin Oakes takes up the gauntlet and compares the Apple II and the IBM PC for speed in doing a Shell sort.

Having just acquired Microsoft Basic (AMB) for the Atari 800, I was most curious to compare performance.

Atari owners, rejoice. In a sort of 500 random numbers, the Atari is five times faster than the IBM and nine times faster than the Apple. The Apple takes 444 seconds, the IBM 266 seconds and the Atari with AMB, 48 seconds!

The program run on the Atari is identical to that listed for the IBM in the June issue except that AMB has (TIME) as well as (TIMES). TIME returns the time in jiffies (60ths of a second), therefore lines 190 and 200 are redundant along with the variables AS and BS.

A listing for the Atari Shell sort can be seen in Listing 1. This type of speed comparison is not a conclusive determination of speed, but should show current and prospective Atari owners that with the addition of Microsoft Basic, they indeed have powerful machines.

It is interesting to note that Atari's notoriously slow 8K ROM Basic took 543 seconds for this same sort, only slightly slower than Applesoft.

Michael Reichmann
Toronto, Canada

Micro Digest

Compiled by Dan Muse

A2-3D1, A2-3D2 and A2-GE1 Graphics Package

(Reviewed in Micro, May 1982)

System Requirements: Apple II with 48K bytes of RAM and disk drive

Manufacturer: Sublogic Communications Corp., 713 Edgebrook Drive, Champaign, IL
Price: \$119.85

Comments: "Impressive features, superb documentation and surprisingly well written" are some of the superlatives used to describe the A2-3D2 and A2-GE1 graphics package.

The program helps the user project and maneuver three-dimensional shapes on a two-dimensional screen.

There is no problem interfacing this program to those in Basic. One problem is that a great deal of memory and disk space is needed. The review lists the skill requirements as competency in Basic programming with some exposure to assembly language. Reader Service number 401.

Optimiser

(Reviewed in InfoWorld, May 24, 1982)

System Requirements: Apple II Plus or Apple II with Applesoft Basic, DOS 3.3, 48K bytes of RAM, one disk drive and an optional printer

Manufacturer: Caxton Software Publishing Company, Freepost 4032, London WC2E 9BR, England

Comments: Optimiser is an electronic spreadsheet program designed to aid in solving linear-programming problems.

"Optimiser does a fine job of solving linear-programming problems once they have been formulated," says the review. The problem is that it is difficult to reduce a real business problem to a set of variables and constraints.

The program requires that the user have experience with how linear programming is applied to problems. "Above all," the review says, "it requires someone who can do some creative thinking."

If you use linear programming to solve problems or if you have studied linear programming and are interested in using it to solve problems, according to the review, you need Optimiser. Reader Service number 413.

Word Right

(Reviewed in Personal Computing, June 1982)

System Requirements: CP/M 56K bytes of RAM

Manufacturer: Structured Systems Group, 5204 Claremont, CA 94618

Price: \$500

Comments: This word-processing program is designed for ease of use. In fact, it is ready for use an hour after it is received.

Word Right has the ability to read files it did not create, so documents created by the user's previous word processor can be worked with, according to the review.

Word Right also features proportional spacing; this is rare for CP/M machines. "Word Right limits the number of words or characters on a line to the number that will appear on the proportionally spaced, printed documents."

The program also has small stick-ons to be placed on the keys so their commands do not have to be memorized. There is also a Help function which lets the user query the program about any command. Reader Service number 416.

Night Mission Pinball

(Reviewed in Softalk, May 1982)

System Requirements: Apple II, Apple II Plus and Apple III, 48K bytes and one disk drive

Manufacturer: Sublogic, 713 Edgebrook Drive, Champaign, IL 61820

Price: \$29.95

Comments: "The verdict is fantastic," according to the review.

The user has the option of choosing any of ten modes designed or he can design one of his own. "Actually, you can design and save as many as 90 modes of your own, plus ten modifications of Sublogic modes, and still have the original ten modes on disk at the same time," says the review.

The game places you over several cities where you are running a night bombing mission. The color hi-res graphics and the animation are excellent.

"The configuration of features—placement of bumpers, difficulty of dropping through side, distance between flippers and so on—is realistic and competitive." Reader Service number 420.

The Big 4

(Reviewed in Personal Computing, May 1982)

System Requirements: Apple II or Apple III

Manufacturer: State of the Art, 3183-A Airway Ave., Costa Mesa, CA 92626

Price: Apple II—\$395–\$495; Apple III—\$495–\$595

Comments: The Big 4 offers accounting applications in the areas of budget and financial reporting, general ledger, accounts payable and accounts receivable. Each of these programs can "either stand alone or be combined with other programs," says the review.

The package consists of "concise documentation that allows first-time users to begin using the software immediately."

The applications can be changed, within the bounds of the system design, to meet the user's specific needs. Reader Service number 408.

MatheMagic

(Reviewed in Softalk, April 1982)

System Requirements: Apple

Manufacturer: International Software Marketing, Suite 421, University Building, 120 East Washington St., Syracuse, NY 13202

Price: \$89.95

Comments: Your Apple can now add 1 + 1. *MatheMagic* will allow your personal computer to do what you, perhaps, thought it could not.

Actually, the *MatheMagic* program goes well beyond simple math. The product was billed by International Software Marketing as a "programmable calculator." However, the company's billing does not do justice to its product. *MatheMagic* allows its user to design formulas and apply labels to them so they can be recalled from the disk.

With two disk drives the product functions "like a dream," according to the review. The results of single-disk-drive users are not so impressive, but the company has "pledged to replace all 1.5A versions upon receipt of the warranty card," according to the review.

The program is an asset to the Apple user. Reader Service number 400.

The Depreciation Planner

(Reviewed in InfoWorld, May 24, 1982)

System Requirements: Apple II Plus or Apple II with Applesoft or Apple III. 48K bytes of RAM and two disk drives and a printer

Manufacturer: Dakin5 Corp., PO Box 21187, Denver, CO 80221

Price: \$395

Comments: The Depreciation Planner is designed for the small to medium-sized business that has enough capitalized assets to require some planning and maintenance of records for depreciation scheduling and tax planning.

The review says, "A significant effort has gone into The Depreciation Planner to insure that the program is both flexible and up to date."

The review rates The Depreciation Planner as excellent in performance, documentation and error handling. Reader Service number 411.

Kidstuff

(Reviewed in InfoWorld, May 1982)

System Requirements: Commodore

Manufacturer: Thomas R. Smith, PO Box 345, Dedham, MA 02026

Price: \$59.95

Comments: The review rates Kidstuff excellent in all departments and describes it as a "simple and inexpensive graphics language that takes full advantage of the Commodore computers' features."

"The simple and error-free performance of the system matches the needs of this market exactly," according to the review. The product is geared toward educators who may not have actual computer experience.

Although the program is designed to appeal to children, adults may find it enjoyable as well. Reader Service number 402.

PL/1

(Reviewed in Byte, June 1982)

System Requirements: CP/M version 1.4 or higher, MP/M 8080, 8085 or Z80 processor with 48K bytes and two eight-inch disk drives

Manufacturer: Digital Research, PO Box 579, Pacific Grove, CA 93950

Price: \$500; documentation alone is \$35.

Comments: PL/1 for microcomputers allows you to "do all of your programming in one language," according to the review. Digital Research's support for its product is excellent, says the review.

The program's primary appeal is to the person who owns more than one computer. Reader Service number 404.

The Graphics Magician

(Reviewed in Softalk, May 1982)

Systems Requirement: Apple system

Manufacturer: Penguin Software, 830 4th Ave., Geneva, IL 60134

Price: \$59.95

Comments: The Graphics Magician will allow you to create things you never thought you could. The program is designed "as a tool for programmers to help them design and store graphics files that will be called from their own Basic or machine language program," says the review.

The product actually consists of three separate packages: an animation package, an editor for drawing a full-screen picture and independently placing one or more objects in the picture, and a program called "Super Shapes."

The review says, "The Graphics Magician is not a toy," but rather a valuable tool. Reader Service number 406.

Hi-Res Golf is a
cut above computer games;
it is a computer sport.

Tax Beater

(Reviewed in Softalk, April 1982)

System Requirements: Apple II, Apple II Plus or Apple III, 48K bytes and one disk drive

Manufacturer: DataMost, 19273 Keyne St., Northridge, CA 91326

Price: \$129.95

Comments: "Tax Beater is the easiest tax software to use," says the review, "but don't use it if you plan to be audited."

Tax Beater can be valuable if used within the proper framework. The program's main attraction is its ability to provide the user with several different calculations using only a minimal amount of data. The program is for the taxpayer who "wants reliable numbers in the most painless fashion possible," says the review.

An extra attraction of the program is its ability to inform the user whether his deductions are high, low or average for his income.

Tax Beater's major flaw, according to the review, is that it lacks the documentation capabilities of competitive packages. Therefore, if you do plan to be audited, this program won't be of much use. Reader Service number 417.

Hi-Res Computer Golf

(Reviewed in Softalk, February 1982)

System Requirements: Apple II, Apple II Plus or Apple III, 48K bytes and one disk drive

Manufacturer: Avant-Garde Creations, Box 30160, Eugene, OR 97403

Price: \$29.95

Comments: "Hi-Res Computer Golf is a masterpiece game of judgment, strategy, visual keenness and skills," says the review. Hi-Res Golf is a cut above computer games; it is a computer sport.

The graphics are excellent. The course is complete with sand traps, roughs, lakes, ponds and trees. Hi-Res Golf offers very realistic features. The player must take wind velocity into consideration before each shot. The proper club must also be chosen. This selection, as in real golf, is based on the distance you wish to hit the ball.

"The authors seem to have thought of every possible detail to make playing the game simple and pleasing to the gamer," says the review.

Hi-Res Computer Golf is not easy and a great deal of practice will be necessary to master it. Anyone who spends his weekends on the local golf course will surely appreciate the difficulty factor of this computer sport. Reader Service number 407.

Professional Timekeeping System

(Reviewed in InfoWorld, May 24, 1982)

System Requirements: Apple II plus, DOS, 48K bytes of RAM, two disk drives and a 132-column printer

Manufacturer: Computer Consulting Services, 1822 Drew St., Clearwater, FL 33515

Price: \$1500

Comments: "This program lets you account for your staff's time, bill clients and analyze your time and billing patterns," says the review. The system is aimed at offices of professionals (e.g., lawyers, accountants, etc.).

The program features reports on time spent and money earned for each staff member. It maintains a running journal file for each client to record all of his activity. The user can record five different costs in the systems journal file: cost, fee, cost deposit, retainer and payment. It also includes several utility functions.

One flaw with the program is that "the error handling is incomplete," according to the review. The program "is relatively sensitive to operating errors and is vulnerable to operator errors that could cause a loss of data."

The review lists the performance and ease of use of Professional Timekeeping Systems as good, but its documentation and error handling are only fair. Reader Service number 414.

Heslister

(Reviewed in InfoWorld, May 24, 1982)

System Requirements: PET/CBM, 8K bytes of RAM, one disk drive and an optional printer

Manufacturer: Human Engineered Software, 3748 Inglewood Blvd., #11, Los Angeles, CA 90066

Price: \$12.95

Comments: Heslister differs from standard Commodore list functions in several respects, according to the review. "It reads program files, block by block. It reads each program line and reformats it, putting spaces around key words, indenting and inserting carriage returns after colons."

"This is a useful programming debugging tool. . . . Anyone who has tried to transcribe densely packed programming from magazine articles can appreciate the advantages of structured listings," says the review.

It is good in error handling and documentation; it is excellent in ease of use and performance. Reader Service number 412.

Letter Perfect ROM

(As Reviewed in Infoworld, June 7, 1982)

System Requirements: Atari

Manufacturer: LJK Enterprises, Inc., Box 10827, St. Louis, MO 63129. \$249.95

Comments: "Proves the Atari can be transformed into a reasonable word-processing machine."

Although the documentation is "verbose," it is a "good word processor, and you should consider it when looking to make your Atari more useful." Reader Service number 425.

LogOn

(Reviewed in Personal Computing, June 1982)

System Requirements: LogOn can be transported to any UCSD Pascal-based personal computer

Manufacturer: Ferix Microsystems, 1701 N. Ft. Myer Drive, Suite 611, Arlington, VA 22209

Price: \$150

Comments: "LogOn converts the IBM Personal Computer, Apple II or Apple III into an auto-dial, auto-answer intelligent terminal for communication with other computers," according to the review.

"Users can exchange messages, electronic mail, program files or graphic images at 30 to 120 characters per second, depending on the equipment used.

LogOn provides financial modeling combined with consolidation of data and menu-driven graphic display of the results when interfaced with Ferix Microsystems' Micro-DDS/Finance financial modeling and GraphPower graphics plotting packages. Reader Service number 419.

Select Word-Processing System

(Reviewed in InfoWorld, May 1982)

System Requirements: CP/M, MP/M or CDOS, 48K bytes of RAM and two disk drives

Manufacturer: Select Information Systems, Inc., 919 Sir Francis Drake Blvd., Kenfield, CA 94904

Price: \$595

Comments: Select Word-Processing does not "succeed on all counts," but it is "powerful and useful," according to the review.

There are some minor problems with Select such as not giving the user an error message when he attempts to edit a nonexistent file. Most of the problems, though, are not that serious and on the whole the program is good. Reader Service number 403.

Hi-Res Secrets

(Reviewed in Softalk, April 1982)

System Requirements: Apple II, Apple II Plus or Apple III, 48K bytes and one disk drive

Manufacturer: Avant-Garde Creations, Box 30160, Eugene, OR 97403

Price: \$125

Comments: "If you are interested in graphics programming and dream of writing programs like 'Raster Blaster' or 'Sneakers,' then Hi-Res Secrets is probably a good starting point."

"Hi-Res Secrets is a complete graphics tutorial for the Apple," according to the review. The package covers all hi-res graphics subjects except three-dimensional animation.

"The documentation is comprehensive, although sometimes a bit confusing, says the review, but otherwise excellent.

The user is expected to know Basic and some assembly language. Reader Service number 418.

Address Book

(Reviewed in Purser's, Fall 1981 edition)

System Requirements: Apple II disk and DC Hayes modem

Manufacturer: Muse Software

Price: Not listed

Comments: "This is a good program," says the review. "The program is well written and easy to use."

The program functions best when used with a DC Hayes telephone connection. "With this extra piece of hardware, the program will actually dial the telephone calls for you," says the review.

If you do not have a DC Hayes telephone connection, you may not find this program particularly useful. Reader Service number 410.

PMS-II

(Reviewed in Personal Computing, June 1982)

System Requirements: Any personal computer system that supports CP/M or MP/M operating systems

Manufacturer: North America MICA, Inc., 11772 Sorrento Valley Road, Suite 240, San Diego, CA 92121

Price: \$1295

Summary: Critical-path analysis systems are not just for expensive mainframes, minicomputers and time-sharing services anymore.

PMS-II makes it possible for many companies to "unhook from their expensive mainframe or time-sharing services, and place project management capability at the job site or in the project manager's own department," according to the review.

PMS-II's speed of computation and report generation gives the project manager "the luxury of playing out various 'what if' scenarios until all dates and durations are fully optimized," says the review. Reader Service number 415.

Tricky Tutorials

(As Reviewed in Micro, June 1982)

System Requirements: Atari

Manufacturer: Santa Cruz Educational Software, 5425 Jigger Drive, Soquel, CA 95073

Price: \$14.95 per tutorial

Comments: "Combines the computer with the power inherent in color graphics and sound."

These helpful, but demanding, tutorials instruct you in the use of hardware buried inside each Atari. Reader Service number 423.

Cashbook 2.0

(Reviewed in Softalk, May 1982)

System Requirements: Apple II, Apple II Plus and Apple III, 48K bytes and one disk drive

Manufacturer: Zofarry Enterprises Pty. Ltd., 35 Northcote St., Haberfield, N.S.W., Australia 02-7978832

Price: \$149

Comments: "Cashbook is a model of friendliness," says the review. The review describes Cashbook as "a small-business, single-entry accounting system with an Australian accent."

The program offers single-key commands to increment or decrement transaction numbers. A polite, but informative, error message accompanies the rejection of illegal data, according to the review.

The package offers many attractive features; however, it does lack the ability to key in a budget and generate reports of actual expenditures versus projected amounts. Reader Service number 421.

Vocabulary Game

(Reviewed in Peelings II, April 1982)

System Requirements: Applesoft ROM, 48K bytes, disk II and DOS 3.2/3.3
Manufacturer: J & S Software, 140 Reid Ave., Port Washington, NY 11050
Price: \$24.95

Comments: The Vocabulary Game helps students expand their vocabulary through a baseball game format. Students can go for either a single, double or triple. Obviously, a triple would be a much more difficult word than a single.

The program's biggest disadvantage, according to the review, is that it is locked so new words cannot be added to the program's vocabulary. Another disadvantage is that when an incorrect answer is given, a full definition is not given; it gives only a synonym.

The program is easy to use for someone who is unfamiliar with computers. Reader Service number 409.

Apple-Cillin

(As Reviewed in Peelings II, April 1982)

System Requirements: Apple
Manufacturer: XPS, Inc., 323 York Road, Carlisle PA 17013. \$39.95

Comments: Does not live up to its advertisement of providing hardware diagnostics at a previously impossible level, the review says. The moderately experienced programmer will find Apple-Cillin unexciting, the review says. Reader Service number 424.

Psort

(Reviewed in Softalk, May 1982)

System Requirements: Apple II, Apple II Plus or Apple III, 48K and one disk drive
Manufacturer: Special Delivery Software, 10260 Bandle Drive, Cupertino, CA 95014
Price: \$85

Comments: "Psort is a utility package for users of the Apple Pascal operating system," says the review. Its primary purpose is to alphabetically sort and merge files.

Psort is provided on a disk in three separate forms: "as a compiled program for immediate, independent execution; as the source files for that compiled file for program modification by the user; and as source code for a Psort procedure to be included in user programs."

The review lists a number of flaws in the current version of Psort. By this time, however, the company may have corrected the problems.

Psort is designed for the sophisticated Pascal programmer "who is willing to recompile the sources provided, and perhaps to make minor modifications." Reader Service number 422.

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3-6763

Enhance Atari I/O Capabilities

Learn how to use the Atari's built-in I/O handlers to extend the types of programs you can run on the 800 system.

By John Baseler

Writing an assembly-language program for the Atari 800 is easy with the Assembler/Editor car-

tridge, but the lack of connections in the cartridge to the input/output routines limits the type of programs that

can be run. Since the Atari operating system has I/O handlers built in, all that needs to be done is to connect to the proper operating system routines.

The program listing uses some of the I/O capabilities of the Atari 800, and therefore extends the type of programs that can be run to more than USR routines for the Basic cartridge.

The specific type of I/O used in this program is a character at a time for read or write, although block transfers can be done. This routine is designed to be used in the debugger mode of the Assembler/Editor cartridge, but it can be used under different circumstances if necessary. I won't deal with the internal workings of Atari operating system routines, except to describe how to link to them in a limited way.

The Program

All that this program needs is to link with the proper routines. The I/O handlers link through a common location (E456, hexadecimal). The operating system routine at this location determines the type of handler that is being requested and jumps to the appropriate routine. It does this by looking into a table at 340 (hexadecimal). This table must be filled with the appropriate values before jumping to the subroutine at E456. The

Program listing. This program connects the Atari 800's I/O handlers to needed operating system routines for easy assembly-language programming.

```
; ATARI I/O BY JOHN BASELER
;
; DEFINE I/O BLOCKS
;
IOBL2  = $20 ; SCREEN BLOCK
IOBL3  = $30 ; KEYBOARD BLOCK
IOBL4  = $40 ; CASSETTE BLOCK
IOBL5  = $50 ; DISK BLOCK
;
IOHID  = $340 ; START OF I/O BLOCKS
IODNO  = IOHID +1
IOCOM  = IODNO +1
IOSTA  = IOCOM +1
IOBAL  = IOSTA +1
IOBAH  = IOBAL +1
IOPTL  = IOBAH +1
IOPTH  = IOPTL +1
IOBLL  = IOPTH +1
IOBLH  = IOBLL +1
IOAX1  = IOBLH +1
IOAX2  = IOAX1 +1
;
; DEFINE VARIABLES
;
CR      = $9B ; CARRIAGE RETURN
BUFMAX  = 1   ; # CHARACTERS TO BE MOVED
SPACE   = $20 ; SPACE CHARACTER
BS      = $7E ; BACK SPACE
;
; DEFINE COMMANDS TO HANDLER
;
OPEN    = 3   ; OPEN HANDLER
CLOSE   = $C   ; CLOSE HANDLER
```

More

Address correspondence to John Baseler, 1400 29th St. NE, Cedar Rapids, IA 52402.

routine at E456 returns its status in the Y register when it returns to the calling routine. The error codes are discussed in the Atari manuals.

Before you can use an I/O handler, it must first be opened. An attempt to open a handler more than once will generate an error. If the debugger is exited via the X command, all user handlers are closed.

My program does have the ability to close the handlers, so a user program can close the two handlers. This feature can be used if the user program crashes. G (address of Stop) closes the handlers and another G (address of Cold) restarts the program. You don't have to exit and then reenter the debugger to close the I/O handlers.

Each I/O block is 16 bytes long. The first I/O block is the screen editor, which must not be closed because my I/O program uses it to perform backspaces. The screen editor can be used for a line at a time of input or output. That may give you some idea of the 800's other I/O capabilities.

There are three user jumps that can be entered by using the G (address of jump) command in the debugger. They are located at the origin, origin +3 and origin +6. The first is labeled Cold; it opens the two handlers before jumping to the user program. The second is OpenO; it opens the two I/O handlers and returns to the debugger via a BRK (break). The last is Stop, which closes the two handlers and returns to the debugger via a break.

If an error occurs during a call to E456, the I/O program branches to an error routine (Error). Error stores the A, X and Y registers in Buffer and then executes BRK. The X register contains the I/O block being accessed; the Y register contains the error code. The debugger can be used to check the Buffer locations to help determine why an error occurred.

The user program needs the address of two routines to do input and output. The labels CHRIN and CHROUT or INCHR and OUTCHR can be used. INCHR and OUTCHR are the actual routines while CHRIN and CHROUT are jumps to INCHR and OUTCHR. Since CHRIN and CHROUT are in an area of the program that will not change address with code changes to the program, it is best to use them to link to user programs. Then, if a change is made to the I/O program code, the user programs need not be changed, which is

Listing continued.

```

READ      = 4 ; READ ONLY HANDLER
WRITE     = 8 ; WRITE ONLY HANDLER
RDWR      = %C ; READ/WRITE HANDLER
GETCHR    = 7 ; GET CHARACTER
PUTCHR    = %B ; PUT A CHARACTER
;
; DEFINE MEMORY LOCATIONS
;
CIOV      = %E456 ; O.S. HANDLER LOCATION
CUREN     = %2F0 ; CURSOR ENABLE
COLCRS    = %55 ; COLUMN LOCATION OF CURSOR
ROWCRS    = %54 ; ROW LOCATION OF CURSOR
;
; START OF I/O PROGRAM
;
      *= %600
COLD      JMP START ; OPEN HANDLERS - USER PROGRAM
OPENO     JMP OPENP ; OPEN HANDLERS ONLY
STOP      JMP END   ; CLOSE HANDLERS
CHRIN     JMP INCHR ; VECTOR TO INPUT
CHROUT    JMP OUTCHR ; VECTOR TO OUTPUT
;
; ERROR ROUTINE FOR I/O PROGRAM
;
ERROR      JSR PUSH ; SAVE REGISTERS
           BRK      ; RETURN TO DEBUGGER
;
; I/O HANDLER TYPES - CIOV USES
; ADDRESS OF TYPE TO GET IT.
;
KEY        .BYTE 'K' ; KEYBOARD
SCRN       .BYTE 'S' ; SCREEN
CAS        .BYTE 'C' ; CASSETTE
DIS        .BYTE 'D' ; DISK
;
; OPEN KEYBOARD
;
OPENKB     LDX #IOBL3 ; BLOCK NUMBER
           LDY #KEY & %FF ; HANDLER TYPE
           LDA #READ ; DIRECTION OF DATA
           JMP OPENCM ; JUMP TO COMMON
;
; OPEN SCREEN FOR WRITES
;
OPENSC     LDX #IOBL2 ; BLOCK NUMBER
           LDY #SCRN & %FF ; HANDLER TYPE
           LDA #RDWR ; DIRECTION OF HANDLER
;
; COMMON OPEN ROUTINE
;
OPENCM     STA IOAX1,X
           LDA #OPEN ; HANDLER COMMAND
           STA IOCOM,X ; STORE COMMAND
           LDA #0
           STA IOAX2,X
           TYA ; STORE LOCATION
           STA IOBAL,X ; OF TYPE OF HANDLER
           LDA #KEY/256 ; IN BLOCK
           STA IOBAH,X
           JSR CIOV ; I/O HANDLER
           BPL OPEN2 ; BRANCH NO ERROR IN Y
           JMP ERROR
OPEN2      RTS
;
; CLOSE KEYBOARD
;
CLOSEK     LDX #IOBL3 ; BLOCK NUMBER

```

More →

Listing continued.

```
                JMP CLOSEC ; JUMP TO COMMON
;
; CLOSE SCREEN
;
CLOSES LDX #IOBL2 ; BLOCK NUMBER
;
; COMMON ROUTINE
;
CLOSEC LDA #CLOSE ; HANDLER COMMAND
        STA IOCOM,X ; STORE COMMAND
        JSR CIOV   ; I/O HANDLER
        RTS
;
; READ KEYBOARD CHARACTER - PUT INTO
; BUFFER
;
READKB LDX #IOBL3 ; BLOCK NUMBER
        LDA #GETCHR ; HANDLER COMMAND
        JMP MOVEC  ; JUMP TO COMMON
;
; WRITE CHARACTER IN BUFFER TO SCREEN
;
WRITES LDX #IOBL2 ; BLOCK NUMBER
WRITEE LDA #PUTCHR ; HANDLER COMMAND
;
; COMMON ROUTINE
;
MOVEC STA IOCOM,X ; STORE COMMAND
        LDA #BUFFER & $FF ; STORE BUFFER
        STA IOBAL,X ; ADDRESS IN
        LDA #BUFFER/256 ; BLOCK
        STA IOBAH,X
        LDA #BUFMAX ; LENGTH OF BUFFER
        STA IOBLL,X ; IS STORED IN
        LDA #0 ; I/O BLOCK
        STA IOBLH,X
        JSR CIOV ; I/O HANDLER
        BPL MOVE2 ; BRANCH IF NO ERROR
        JMP ERROR
MOVE2 RTS
;
; START OF I/O ROUTINES - COLD START
;
START JSR OPENSCL ; OPEN SCREEN
        JSR OPENKB ; OPEN KEYBOARD
        JMP MAIN ; JUMP USER PROGRAM
;
; OPEN HANDLERS ONLY - THEN BREAK
;
OPENP JSR OPENSCL ; OPEN SCREEN
        JSR OPENKB ; OPEN KEYBOARD
        BRK ; RETURN TO DEBUGGER
;
; CLOSE BOTH HANDLERS
;
END JSR CLOSES ; CLOSE SCREEN
        JSR CLOSEK ; CLOSE KEYBOARD
        BRK ; RETURN TO DEBUGGER
;
; GET ONE CHARACTER, PUT IN ACCUM.
; USER PROGRAM MUST JSR INCHR TO READ
; ONE CHARACTER.
;
INCHR JSR PUSH ; SAVE REGISTERS
        JSR READKB ; GET CHARACTER
        JSR POP ; RESTORE REGISTERS
```

a nice feature if there are a number of user programs.

The user program can also jump to End when it is completed. To do I/O a JSR (jump to subroutine), CHRIN or JSR CHROUT can be used. Both restore the registers before exiting the routines. The INCHR routine will wait for a key to be pressed, and after the key is pressed will return the value for that key to the accumulator.

OUTCHR must be passed the value of the character in the accumulator. It is the user's program's responsibility to echo input characters to the screen if an echo of keys pressed is desired. For the backspace to delete the last character on the screen, it must be echoed.

Limitations

The only special key allowed is the backspace. All other special keys will give Atari display characters. The carriage return for this machine is a 9B, which is not standard ASCII. If you want to connect routines to the Atari 800, the carriage return must be 9B or the user must trap the carriage return and do the appropriate conversions on it.

I ran into this problem with Tiny-C, which uses D for a carriage return value. The fix I used was to convert Tiny-C to accept 9B for the carriage return. The labels KEY, SCRNLAS, and DIS must reside in the same page of memory if this program is to work.

The program can be installed anywhere it doesn't conflict with other memory usage. I used page 6 for my code. If you're using a disk, be careful where you put your code so you don't write over the DOS. The only scratch space used by this program is Buffer, which is three bytes long. This program is set up for the default screen boundaries; if any other values are used the carriage return may skip extra lines on the screen. To fix that problem alter CMP (compare accumulator and memory) #3 in OUTCHR to the appropriate value.

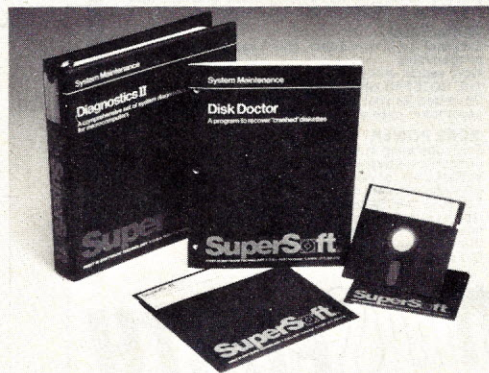
Conclusion

I hope this brief explanation of my I/O program and the Atari I/O handlers will encourage other people to experiment in this area. Since the program listed is not the only way to get the job done, I hope to see modifications to it in the future. The best way to learn about the Atari software is to buy the Atari manuals and experiment. ■

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Listing continued.

```

RTS
;
; WRITE ONE CHARACTER TO SCREEN
; USER PROGRAM MUST JSR OUTCHR
; TO WRITE ONE CHARACTER -
; CHARACTER MUST BE IN ACCUM.
;
OUTCHR JSR PUSH ; SAVE REGISTERS
      CMP #BS ; CHECK FOR BACKSPACE
      BEQ BS1 ; BRANCH IF BACKSPACE
      CMP #CR ; CHECK IF CARRIAGE RETURN
      BNE OUTCH2 ; AND BRANCH IF NOT CR
      STA CUREN ; TURN CURSOR OFF FOR NEXT BYTE
      LDA #SPACE ; SEND SPACE TO SCREEN
      STA BUFFER ; TO KILL OLD CURSOR
      JSR WRITES
      LDA COLCRS ; IF CURSOR JUMPED TO NEXT
      CMP #3 ; LINE THEN =3 SO
      BPL OUTCH1 ; NO BRANCH
      DEC ROWCRS ; MOVE CURSOR BACK TO OLD LINE
OUTCH1 LDA CUREN ; RESTORE CR CODE
      LDY #0 ; TURN CURSOR ON FOR
      STY CUREN ; NEXT BYTE
      STA BUFFER ; PUT CHARACTER IN BUFFER
OUTCH2 JSR WRITES ; PUT CHARACTER ON SCREEN
      JSR POP ; RESTORE REGISTER
      RTS
;
; BACKSPACE - USE SCREEN EDITOR AT
; I/O BLOCK 0
;
BS1 LDX #0 ; BLOCK NUMBER
    LDA #7E ; BACKSPACE CHARACTER
    STA BUFFER ; READY TO SEND
    JSR WRITEE ; SEND BACKSPACE
    JSR POP ; RESTORE REGISTERS
    LDA #BS ; RESTORE BS TO ACCUM.
    RTS
;
; SAVE REGISTERS IN BUFFER
;
PUSH STA BUFFER
     STY BUFFER + 1
     STX BUFFER + 2
     RTS
;
; RESTORE REGISTERS FROM BUFFER
;
POP LDA BUFFER
   LDY BUFFER + 1
   LDX BUFFER +2
   RTS
;
; BUFFER LOCATION - THREE BYTES
;
BUFFER .BYTE $0,$0,$0
;
; EQUATE FOR MAIN PROGRAM BEGIN
; OR MAIN PROGRAM
;
MAIN JSR CHRIN ; READ CHARACTER
     JSR CHROUT ; WRITE CHARACTER
     CMP #'%' ; CHECK IF % KEY
     BNE MAIN ; REPEAT IF NOT
     JMP END ; DONE
     .END

```


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Microcomputing, August 1982 33

Equip Your Apple For the Challenge

Use an arithmetic processor to let your Apple perform special math functions in Pascal.

By Peter Heilmann

I use my Apple II primarily for scientific calculations and data processing. Since the programs are complex yet must run reasonably fast, I use Pascal. Still, floating point arithmetic is slow. This shows up especially when many logarithmic and exponential functions are used.

I therefore upgraded my system with an arithmetic processor (CCS 7811B), sold by California Computer Systems (Santa Clara, CA 95050). This small board fits in any of the Apple expansion slots. It contains an arithmetic processor IC, a MOS/LSI chip, AM9511A, which is manufactured by Advanced Micro Devices, Inc. (901 Thompson Place, Sunnyvale, CA 94086).

This chip is very similar to a pocket calculator's and is specially designed to interface with the eight-bit bus of microprocessors. It performs fixed-point 16- and 32-bit operations, as well as floating-point 32-bit operations. All trigonometric and exponential functions are available, as well as conversion functions. The typical execution times are ten to 50 times faster than the equivalent Basic or Pascal functions, if they are available at all.

Though all this sounds very fine, the disappointment came when I got

my arithmetic processor. There was full software support for Basic, but none for Pascal, which was not at all clear from the ad. I called CCS and learned that software support for Pascal is not available, nor is it planned for the future.

Since I was still interested in reducing the execution time of my programs, I decided to write my own software. In Apple Pascal, arithmetic functions are implemented in two different ways. The Pascal interpreter takes care of the basic functions like addition, subtraction, multiplication and division, while the more complex functions (e.g., EXP and LN) are realized by subroutines implemented in a library, called TRANSCEND. Since I had no information about the interpreter, I was not able to use the arithmetic processor with the first type of function. Yet the time gain achieved wouldn't have been very large—maybe a factor of two—and probably not worth the trouble.

The second type of function seemed to be much easier to handle. It is necessary only to write a short assembler program, which sends the argument of the function to the arithmetic processor and returns the result to the main program. These assembler-written subroutines have to

be linked together in a Pascal library for convenient use.

My first attempt to do this failed, and I very soon discovered why: floating point values are represented differently in Apple Pascal and in the arithmetic processor AM9511A, and I needed a conversion routine.

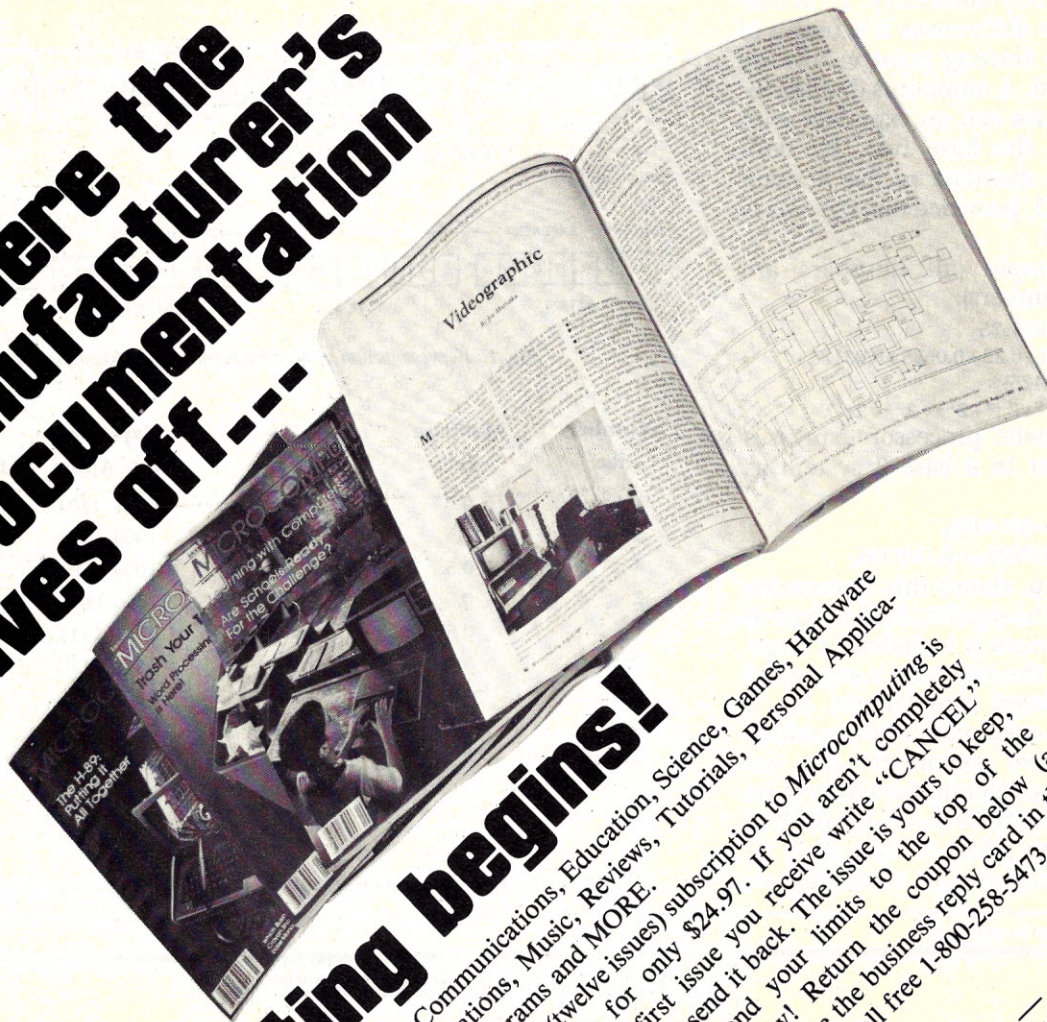
Conversion Routine for Floating Point Values

The format used by the arithmetic processor for floating point numbers is well-documented in its data sheet, whereas the Apple documentation is very poor. I therefore had to use a trial-and-error method to gain some insight into the Apple Pascal floating-point format. The information I give in the following might therefore be slightly inaccurate in some details, even though I've tested it very thoroughly.

Both systems use four bytes for a single-precision floating-point variable, but in the Apple system eight bits are used for the exponent, whereas the AM9511A uses only seven bits. Also, the mantissa is repre-

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sented slightly differently. To understand these differences it is useful to recall how floating point values are represented. A number is divided into a mantissa and an exponent with respect to the base two. By definition, the mantissa m has a value $0.5 \leq m < 1$, provided that the data is normalized.

For example (all numbers are decimal numbers):

$$\begin{aligned} 27.25 &= 2^5 \cdot 0.8515625 \\ &= 2^5 \cdot (0.5 + 0.25 + 0.0625 + 0.03125 + 0.0078125) \\ &= 2^5 \cdot (2^{-1} + 2^{-2} + 2^{-4} + 2^{-5} + 2^{-7}) \end{aligned}$$

The arithmetic processor expresses this number in a base 2 system as follows:

exponent: $5_{10} = 000\ 0101_2$

mantissa: $0.8515625_{10} = 0.1101101_2$

Fig. 1, top, shows this representation again; the sign bit (MSB of byte 4) of the mantissa is included. A negative sign in the exponent is expressed by its unbiased complement. Fig. 2 gives some examples of how positive and negative exponents are expressed; since all numbers have to be normalized ($0.5 \leq m < 1$), the MSB of the mantissa (MSB of byte 3) is always 1, except for the value of zero,

ARITHMETIC PROCESSOR AM9511A

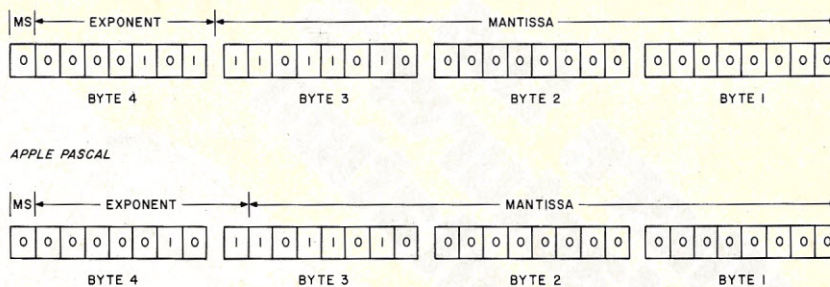


Fig. 1. Representation of floating point values. Example: 27.25.

Number	Mantissa			Exponent	
	dec.	dec.	dec.	bin. Apple	bin. AM9511A
2^{64}	0.5	63		1011 1101	011 1111
8	0.5	4		1000 0010	000 0100
4	0.5	3		1000 0001	000 0011
2	0.5	2		1000 0000	000 0010
1	0.5	1		0111 1111	000 0001
0.5	0.5	0		0111 1110	000 0000
0.25	0.5	-1		0111 1101	111 1111
0.125	0.5	-2		0111 1100	111 1110
0.0625	0.5	-3		0111 1011	111 1101
2^{-65}	0.5	-64		0011 1110	100 0000
0	0	0		0000 0000	000 0000

Fig. 2. Different representation of the exponent by Apple Pascal and the AM9511A.

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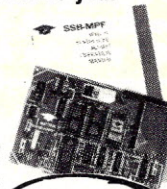
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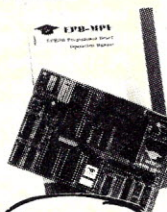


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which is expressed as all bytes zero.

The convention used by Apple Pascal is somewhat different. Again, all values are normalized, but since the MSB of the mantissa is always 1, this bit is not explicitly represented. Thus one bit is gained, which is used for an eight bit representation of the exponent, instead of the seven bits used by the AM9511A.

The exponent is stored in a slightly different manner, too. This time, a biased representation is used, which means that 126_{10} is added to the exponent, and in the example above, the final exponent would be 131_{10} . With this representation, no two's complement is necessary for negative exponents. Fig. 1, bottom, shows the value 27.25_{10} represented in Apple Pascal. Fig. 2 gives some more examples for comparison with the AM9511A format, and shows the differences in the exponent.

A comparison of the two formats shows that the accuracy of the mantissa is the same in both cases, yet in the Apple Pascal system, exponents in the range of about 10^{-38} to 10^{38} can be expressed, compared to 10^{-19} to 10^{19} with the AM9511A. The use of

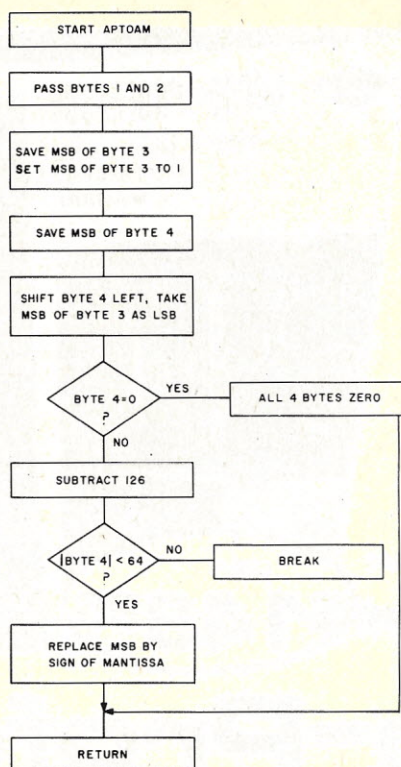


Fig. 3. Flowchart of routine APTOAM.

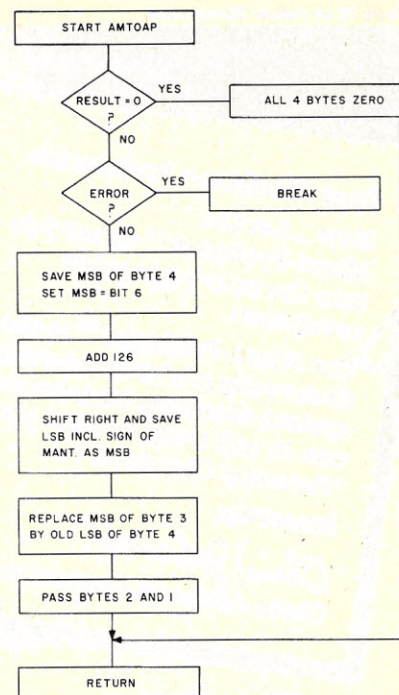


Fig. 4. Flowchart of routine AMTOAP.

floating point values down by a factor of two.

If you know about these differences, it is not difficult to write a conversion routine. Fig. 3 shows the

the arithmetic processor therefore narrows the dynamic range of the

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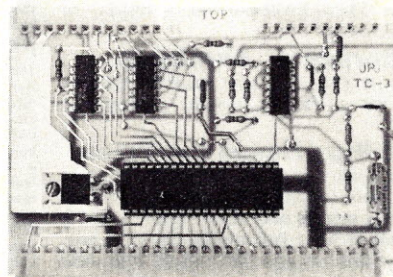
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flowchart for the routine APTOAM, which converts values from the Apple format to the AM9511A format. How it works might be easily understood by applying the flowchart to the example in Fig. 1. Byte 1 and byte 2 are left unchanged; the MSB of byte 3 is replaced by a 1 to get the correct format of the mantissa. Then the ex-

ponent is recovered by using seven bits from byte 4 and the original MSB of byte 3. 126_{10} is subtracted from this exponent and truncated to seven bits. Provisions are made to detect the value of zero, which has the same representation in both systems. An over- or underflow of the dynamic range of the AM9511A will also be

detected and results in a break command, stopping the Apple and reinitializing the system. Even though this method seems to be crude, its result is about the same as the one used in the Apple Pascal system in case of an error, but is much easier to implement.

An assembler code listing for this conversion routine, written with the Apple Pascal assembler, is shown in Listing 1, line 1C to 66. Notice that two macro routines are used, which, while not necessary, are convenient.

The reverse conversion routine AMTOAP is very similar. Fig. 4 shows a flowchart. The conversion starts by checking whether the result of the calculation is zero (zero flag of AM9511A), or whether an arithmetic error occurred (error flag of AM9511A). In the case of an error, another break is executed; in the case of a zero result, all four bytes are set to zero. Otherwise, the conversion routine starts with byte 4. It adds 126_{10} to the exponent, which was prior to this expanded to eight bits. The upper seven bits of the exponent, together with the sign of the mantissa, are the new byte 4. The MSB of the mantissa, which is always 1 (MSB of byte 3), is replaced by the LSB of the exponent. Bytes 2 and 1 are left unchanged. Line 67 to AA in Listing 1 shows the complete assembler code of this routine.

Using the Arithmetic Processor

First you assign the arithmetic processor physically to one slot of the Apple system. It doesn't matter which slot, but the assignment cannot be changed later without changing the software. I use the arithmetic processor in slot 5. The address of the data port of the AM9511A is therefore C0D0, and that of the combined status and command port C0D1.

To use the AM9511A, a number is written into the data port; then the appropriate command for the desired function is issued to the command port. During the calculation, a busy signal can be read from the status port. When the result is ready, the busy signal is switched off and the result can be read from the data port.

Since floating-point values are stored in four bytes and the ports are only one byte (eight bits) wide, the data has to be submitted sequentially. They are input to the AM9511A with byte 1 first, and output with byte 4 first. This agrees well with the format used in Pascal subroutines.

Command	Hex Code	Description
SQRT (X)	01	Square root of X
SIN (X)	02	Sine of X
COS (X)	03	Cosine of X
TAN (X)	04	Tangent of X
ASIN (X)	05	Inverse sine of X
ACOS (X)	06	Inverse cosine of X
ATAN (X)	07	Inverse tangent of X
LOG (X)	08	Common logarithm of X
LN (X)	09	Natural logarithm of X
EXP (X)	0A	e raised to the power X
PWR(X,Y)	0B	X raised to the power Y
PI	1A	Constant π

Fig. 5. Useful functions of the AM9511A.

Listing 1. Apple Pascal/AM 9511A conversion program

```

Current memory available: 10142
0000: ;
0000: ; ASSEMBLER LANGUAGE SUBROUTINES FOR USE
0000: ; WITH THE AM9511A ARITHMETIC PROCESSOR
0000: ; (IN SLOT 5) WITH APPLE PASCAL.
0000: ;
0000: ; WRITTEN BY PETER HEILMANN
0000: ;
0000: ;
0000: .MACRO POP ;STORES RETURN ADDRESS IN Z1, Z1+1
0000: PLA
0000: STA Z1
0000: PLA
0000: STA Z1+1
0000: .ENDM
0000:
0000: .MACRO PAP ;RESTORE RETURN ADDRESS
0000: LDA Z1+1
0000: PHA
0000: LDA Z1
0000: PHA
0000: .ENDM
0000:
0000: 2 blocks for procedure code 9331 words left

0000: .FUNC SQRT,2
Current memory available: 9553
0000: .DEF APTOAM,AMTOAP
0000:
0000: 0000 RETURN .EQU 00 ;SUBROUTINE RETURN ADDRESS
0000: 0002 SUBRET .EQU 02 ;CONVERSION ROUTINE RETURN ADDRESS
0000: C0D0 DATA .EQU C0D0 ;DATA PORT ADDRESS (AM9511 IN SLOT 5)
0000: C0D1 STATUS .EQU C0D1 ;STATUS / COMMAND PORT ADDRESS
0000:
0000: POP RETURN ;STORE RETURN ADDRESS
0000: 68 # PLA
0001: 85 00 # STA RETURN
0003: 68 # PLA
0004: 85 01 # STA RETURN+1
0006: 68 # PLA ;DISCARD 4 BYTES FROM STACK
0007: 68 # PLA
0008: 68 # PLA
0009: 68 # PLA
000A: 20 **** JSR APTOAM ;CONVERT TO AM9511 FORMAT AND LOAD DATA
000D:
000D: A9 01 LDA #01 ;INITIATE
000F: 8D D1C0 STA STATUS ; SQRT FUNCTION
0012:
0012: 20 **** JSR AMTOAP ;CONVERT TO APPLE FORMAT
0015: PAP RETURN ;RESTORE RETURN ADDRESS
0015: A5 01 # LDA RETURN+1
0017: 48 # PHA
0018: A5 00 # LDA RETURN

```

More

Listing 1 continued.

```

001A: 48          *      PHA
001B: 60          *      RTS
001C:
001C:
001C:
001C:          APTOAM  POP SUBRET  ;STORE RETURN ADDRESS
000B* 1C00
001C: 68          *      PLA
001D: 85 02      *      STA SUBRET
001F: 68          *      PLA
0020: 85 03      *      STA SUBRET+1
0022: AD D1C0    WAIT    LDA STATUS  ;AM9511 READY ?
0025: 30FB      BMI WAIT  ;IF NOT, TRY AGAIN
0027: 68          PLA          ;GET BYTE 1
0028: 8D D0C0    STA DATA    ;SEND IT TO AM9511
002B: 68          PLA          ;GET BYTE 2
002C: 8D D0C0    STA DATA    ;SEND IT TO AM9511
002F: 68          PLA          ;GET BYTE 3
0030: 2A          ROL A        ;MOVE LSB OF EXP IN CARRY
0031: 08          PHP          ;STORE IT ON STACK
0032: 38          SEC          ;SET CARRY
0033: 6A          ROR A        ;SET MSB OF MANTISSA = 1
0034: 8D D0C0    STA DATA    ;SEND BYTE 3 TO AM9511
0037: 28          PLP          ;GET LSB OF EXP INTO CARRY
0038: 68          PLA          ;GET BYTE 4 FROM STACK
0039: 2A          ROL A        ;EXP IS NOW IN ACC, SIGN OF MANT. IN CARRY
003A: F0**      BEQ INZERO    ;TEST IF EXP = 0
003C: 08          PHP          ;STORE SIGN OF MANTISSA ON STACK
003D: 38          SEC          ;PREPARE FOR SUBTRACTION
003E: E9 7E      SBC #07E     ;SUBTRACT 126
0040: C9 C0      CMP #0C0     ;EXP < -64 ?
0042: B0**      BCS RRNG      ; NO, THEN CONTINUE
0044: C9 40      CMP #40      ;IF EXP >= 64 ?
0046: 90**      BCC RRNG      ; NO, THEN CONTINUE
0048: 8D D0C0    STA DATA    ;SEND DUMMY BYTE 4 TO AM9511
004B: 00          BRK          ; ERROR, HALT PROCESSOR
0046* 00
0042* 00
004C: 2A          RRNG      ROL A        ;DISCARD MSB OF EXP
004D: 28          PLP          ;GET SIGN OF MANTISSA FROM STACK
004E: 6A          ROR A        ;BYTE 4 READY
004F: 8D D0C0    STA DATA    ;SEND BYTE 4 TO AM9511
0052: 4C ****    JMP CONT     ;CONTINUE, NO ERROR
003A* 00
0055: AD D0C0    INZERO    LDA DATA    ;GET BYTE 3 BACK FROM AM9511
0058: A9 00      LDA #00      ;MAKE
005A: 8D D0C0    STA DATA    ; BYTE 3 AND
005D: 8D D0C0    STA DATA    ; BYTE 4 ZERO
0060:          CONT    PAP SUBRET  ;RESTORE RETURN ADDRESS
0053* 6000
0060: A5 03      *      LDA SUBRET+1
0062: 48          *      PHA
0063: A5 02      *      LDA SUBRET
0065: 48          *      PHA
0066: 60          *      RTS
0067:
0067:
0067:
0067:          AMTOAP  POP SUBRET  ;STORE RETURN ADDRESS
0013* 6700
0067: 68          *      PLA
0068: 85 02      *      STA SUBRET
006A: 68          *      PLA
006B: 85 03      *      STA SUBRET+1
006D: AD D1C0    READY    LDA STATUS  ;AM9511 READY ?
0070: 30FB      BMI READY  ;IF NOT, TRY AGAIN
0072: C9 20      CMP #20      ;RESULT ZERO ?
0074: F0**      BEQ ZERO      ;
0076: 29 1E      AND #1E      ;ARITHMETIC ERROR ?
0078: F0**      BEQ NOERR     ;
007A: 00          BRK          ;ERROR, HALT PROCESSOR
0078* 00
007B: AD D0C0    NOERR    LDA DATA    ;GET BYTE 4
007E: 2A          ROL A        ;SIGN IN CARRY
007F: 08          PHP          ;SAVE IN STACK
0080: 38          SEC          ;SET CARRY
0081: 30**      BMI MIN      ;IF EXP POS THEN
0083: 18          CLC          ;CLEAR CARRY
0081* 00
0084: 6A          MIN      ROR A        ;EXP HAS NOW 8 BITS, BIT 7 = BIT 8
0085: 18          CLC          ;PREPARE FOR ADD
0086: 69 7E      ADC #7E      ;ADD 126
0088: 28          PLP          ;GET SIGN OF MANT. FROM STACK
0089: 6A          ROR A        ;BYTE 4 READY
008A: 48          PHA          ;PUSH IT ON STACK
008B: 08          PHP          ;STORE LSB OF EXP ON STACK
008C: AD D0C0    LDA DATA    ;GET BYTE 3
008F: 2A          ROL A        ;DISCARD MSB
0090: 28          PLP          ;GET LSB OF EXP FROM STACK
0091: 6A          ROR A        ;BYTE 3 READY
0092: 48          PHA          ;PUSH IT ON STACK
0093: AD D0C0    LDA DATA    ;GET BYTE 2
0096: 48          PHA          ;PUSH IT ON STACK
0097: AD D0C0    LDA DATA    ;GET BYTE 1
009A: 48          PHA          ;PUSH IT ON STACK
009B: 4C ****    JMP DONE     ;CONVERSION DONE
0074* 00
009E: A9 00      ZERO      LDA #00      ;PUSH 0 ON STACK FOR ALL BYTES
00A0: 48          PHA
00A1: 48          PHA

```

More →

When an assembler subroutine or function is called from Pascal, the top of the stack contains the return address (two bytes).

Then four bytes are free, which will later contain the result of the function (if any). After this, all the parameters are stored on the stack, using two or four bytes, depending on the types of the variables, integer or real. The least-significant byte pulls off the stack first. Therefore, after saving the return address and discarding the result bytes, the conversion routine APTOAM pulls the parameters byte by byte from the stack, modifies them if necessary, and sends them to the data port of the AM9511A.

These are the first commands in each of the routines using the AM9511A. Listing 1 shows two of these functions, SQRT and SIN. According to the desired function (e.g., SQRT), a command (e.g., 01) is issued to the AM9511A, starting the calculation. Then the conversion routine AMTOAP is called, which checks first for the end of the calculation, and gets the result byte by byte from the AM9511A, converts it, if necessary, and puts it on the stack. Finally, the return address is restored.

Since every function (SQRT, SIN, EXP, ...) uses the same conversion function, these have to be written only once and are defined by using a special syntax, .DEF. Later, they can be referenced by .REF (see the Apple Pascal manual for details). The only difference between the functions is the command, issued to the AM9511A. Fig. 5 shows some of the most useful commands; a complete list can be found in the AM9511A data sheet.

When these functions are assembled, they have to be linked in a library. To do this, a small interface is necessary, which represents the link to Apple Pascal. Again, this is explained in detail in the Apple Pascal manual. Listing 2 shows this interface program, which has to be compiled and linked together with the assembler routines. Then the LIBRARY program, supplied by Apple, can be used to implement this unit into the SYSTEM LIBRARY, replacing the old unit TRANSCEND.

Listing 2 shows all the functions I've implemented. Two functions are set up somewhat differently and may need some explanation. The PWR function (power function $X^{**}Y$) has

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Listing 1 continued.

```

00A2: 48          PHA          ;
00A3: 48          PHA          ;
00A4:             DONE      PAP SUBRET  ;RESTORE RETURN ADDRESS
009C: A400        #          LDA SUBRET+1
00A4: A5 03        #          PHA
00A6: 48          #          LDA SUBRET
00A7: A5 02        #          PHA
00A9: 48          #          RTS
00AA: 60
00AB:
00AB:
0000:             .FUNC SIN,2
Current memory available: 9553
0000:             .REF APTOAM,AMTOAP
0000:
0000: 0000        RETURN      .EQU 00
0000: C0D1        STATUS      .EQU 0C0D1
0000:
0000:             POP RETURN
0000: 68          #          PLA
0001: 85 00        #          STA RETURN
0003: 68          #          PLA
0004: 85 01        #          STA RETURN+1
0006: 68          #          PLA ;DISCARD 4 BYTES FROM STACK
0007: 68          PLA
0008: 68          PLA
0009: 68          PLA
000A: 20 0000      JSR APTOAM
000B:
000B: A9 02          LDA #02
000F: 8D D1C0      STA STATUS
0012:
0012: 20 0000      JSR AMTOAP
0015:
0015: A5 01          #          LDA RETURN+1
0017: 48          #          PHA
0018: A5 00        #          LDA RETURN
001A: 48          #          PHA
001B: 60          RTS
001C:

```

two arguments, and therefore the conversion routine APTOAM has to be used twice to convert and load both arguments. In contrast to that, the function PI (returns the constant p) has no arguments and therefore doesn't need the routine APTOAM at all.

Conclusion

Once the old library TRANSCEND is replaced by the new library, the Pascal system acts exactly as usual. One really can forget about the arithmetic processor, because the system can be used in the same way as before—no new commands are added, nor are any new boot-up routines necessary. The compiler automatically uses the arithmetic processor to calculate the implemented functions. Yet notice that these functions run much faster. The time gain for calculating an EXP, SIN or COS function is about a factor of 12, for an ATAN function about a factor of 40, and a simple SQRT function runs more than 50 times faster than in Apple Pascal.

Furthermore, functions like ASIN, ACOS, TAN or PWR and even the

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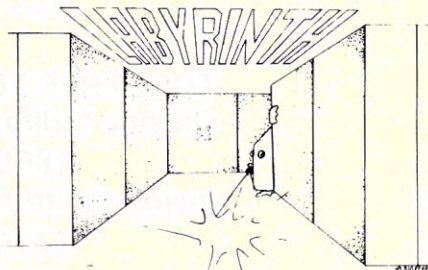
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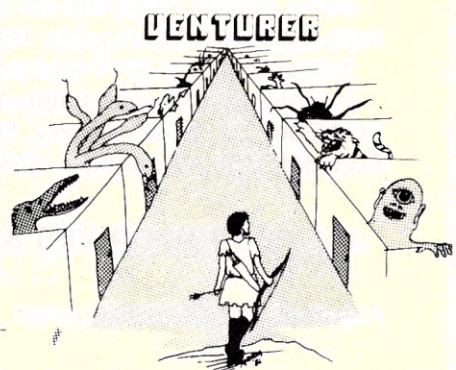
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constant PI are now available, a real improvement over the original Pascal, particularly if you do scientific calculations.

An implementation of the basic mathematical functions ADD, SUB, MUL and DIV would also be nice, but seems to be impossible without knowing more about the Pascal interpreter than is found in the manual. A further time gain would result, but the inevitable loss in dynamic range due to the structure of the AM9511A might be a somewhat bigger disadvantage than with the trigonometric functions.

Examples of how to write and implement assembler subroutines in Apple Pascal are rare, and an explanation of the floating point format used in Apple Pascal doesn't exist in the manual. Therefore, even if you don't intend to use an arithmetic processor, this article might give you some valuable insight about the way Apple Pascal works, and how to write assembler subroutines. This is not always as easy as it seems, especially if you're used to a higher programming language. ■

```
(*S+*)
UNIT TRANSCEND; INTRINSIC CODE 29;
```

INTERFACE

```
FUNCTION SQRT (X:REAL):REAL;
FUNCTION SIN (X:REAL):REAL;
FUNCTION COS (X:REAL):REAL;
FUNCTION TAN (X:REAL):REAL;
FUNCTION ASIN (X:REAL):REAL;
FUNCTION ACOS (X:REAL):REAL;
FUNCTION ATAN (X:REAL):REAL;
FUNCTION LOG (X:REAL):REAL;
FUNCTION LN (X:REAL):REAL;
FUNCTION EXP (X:REAL):REAL;
FUNCTION PWR(X,Y:REAL):REAL;
FUNCTION PI :REAL;
```

IMPLEMENTATION

```
FUNCTION SQRT; EXTERNAL;
FUNCTION SIN; EXTERNAL;
FUNCTION COS; EXTERNAL;
FUNCTION TAN; EXTERNAL;
FUNCTION ASIN; EXTERNAL;
FUNCTION ACOS; EXTERNAL;
FUNCTION ATAN; EXTERNAL;
FUNCTION LOG; EXTERNAL;
FUNCTION LN; EXTERNAL;
FUNCTION EXP; EXTERNAL;
FUNCTION PWR; EXTERNAL;
FUNCTION PI; EXTERNAL;
```

```
BEGIN
END.
```

Listing 2. Functions implemented by the author.

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Fowl Play

PET computers keep score when these pigeons perform.

By Edward K. Crossman

Ppsychologists study animal behavior to better understand human behavior. It's not a new idea: biological science has used animal subjects for over 200 years.

One of the first psychologists to emphasize the importance of studying animal behavior in a laboratory was B. F. Skinner of Harvard University. He argued that psychology must focus on easily observable behavior—any action that affected the environment, such as turning on a light switch or pressing the accelerator in an automobile. He devised a small square box, which served as the experimental environment for studying the behavior of the white rat. This box contained a small lever, a light and a device for delivering food. The rat would receive a small bit of food each time it pressed the lever. Rats—and later, pigeons—could be taught to press the lever for food rather easily, and this behavior was what fascinated Skinner.

Skinner soon found out that rats did not have to get food each time they pressed the lever. If the experimenter required the rats to press ten times, the rats would do so. Or, if food was delivered according to a clock—say once a minute—the rats would learn to let time go by before they started to respond. On the basis of these results, Skinner emphasized that psychology should concentrate on how frequently the rat pressed the lever (rate of responding) and when it

pressed (pattern of responding).

The problem, though, was how to keep track of everything happening in the rat's chamber. Not only did Skinner have to worry about when to schedule the food delivery, but also how to count the lever presses and exactly when they occurred. Automation became necessary, and experimental psychologists turned to the technology available in the 1940s—electromechanical components.

Photo 1 shows a typical rack of relay equipment required to control the events inside one experimental chamber and to record the behavior of the animal inside. In the 1950s and 1960s it was common to find many of these relay racks in the experimental psychologist's laboratory.

In the 1960s some labs replaced the electromechanical modules with smaller, solid-state modules. Then, some psychologists turned away from using modules to the newly invented minicomputer—the PDP-8 from Digital Equipment Corporation, for example. They found that one PDP-8 could do the work of many racks of electromechanical or solid-state modules. What's more, the minicomputer was more accurate and let the psychologist examine behavior in greater detail.

An Example

When Skinner switched to pigeons, he replaced the lever with a small, round plastic disk, behind which was

a microswitch. This disk, or pecking key, could easily be illuminated from behind with various colored lights, the different colors signifying different experimental conditions to the pigeon. It was easy to train hungry pigeons to peck this plastic key to receive small bits of food, and response rates of three to four pecks per second were common.

Although electromechanical equipment can record response rates of this speed, it does so only with great labor. Besides, psychologists want to know more than simply how many pecks occur within the hour-long experimental session. They want to know how many milliseconds (1/1000 of a second) have elapsed between each of the pigeon's pecks and the duration of each keypeck, also a millisecond event.

Enter the minicomputer. The problem of recording with split-second accuracy was duck's (or should I say pigeon's) soup, and psychologists rushed to trade in the old for the new. Minicomputers had the additional advantage of mass storage. All of the events in the experimental session (when key-pecks occurred, when various lights were turned on, etc.) could be saved on magnetic or paper tape for subsequent data analysis.

So far, so good. But minicomputers

Address correspondence to Edward K. Crossman, Department of Psychology, Utah State University, Logan, UT 84322.

were expensive to buy or repair. Repair was particularly a problem for researchers in small cities that were distant from a service center. But then the microcomputer came along.

Enter the PET

I chose the 8K PET by Commodore for several reasons. It was cheaper than the others, and had a real-time clock built into the unit. Additionally, the PET had an IEEE 4888 interface bus, which I felt would be familiar to the engineers at Utah State University who were going to design the interface between the PET and the 28 V dc world of the pigeon.

Inadequate documentation for both the PET and its IEEE-4888 interface made for slow going, and the original design experienced several major modifications. Photo 2 shows the interface connecting the PET to the pigeon chamber.

Psychopet—The Interface

The interface was designed according to the following criteria, which I set forth. First, one PET and one interface would be dedicated to a single pigeon chamber (I have a number of these chambers). Thus, if either computer or interface fails, research in the other chambers can continue without interruption.

Second, I insisted that the system be programmable in Basic so that it would be easy to teach my students, whose curricula are already crowded with psychology courses.

Finally, I wanted the interface not only to control the events inside the chamber (when lights go on or off, when food is delivered, etc.), but also to automatically record on cassette tape in PET format each of these events and the time of occurrence, together with each response and the time it occurred. This automatic recording feature caused the most difficulty, and eventually a Z-80 chip was required to handle the task. (Another Z-80 chip controls events to and from the chamber across the IEEE 488 bus.)

The interface has a 28 V dc supply and can supply 42 different negative 28 V dc current signals (1 amp each) to the chamber. Also, it is possible for the interface to recognize 16 different 28 V dc signals coming from the chamber (key-pecks), although pigeon chambers are typically equipped with only three pecking keys. The interface, whose program occupies about 2K of PROM, can accept a maximum peck rate of four pecks per sec-

ond for 20 seconds before incoming data is lost. Six linked 191-byte buffers hold the event information along with the time of each event. When one of these RAM buffers is filled, it begins to empty onto the cassette tape, while the remaining storage buffers continue to accept event in-

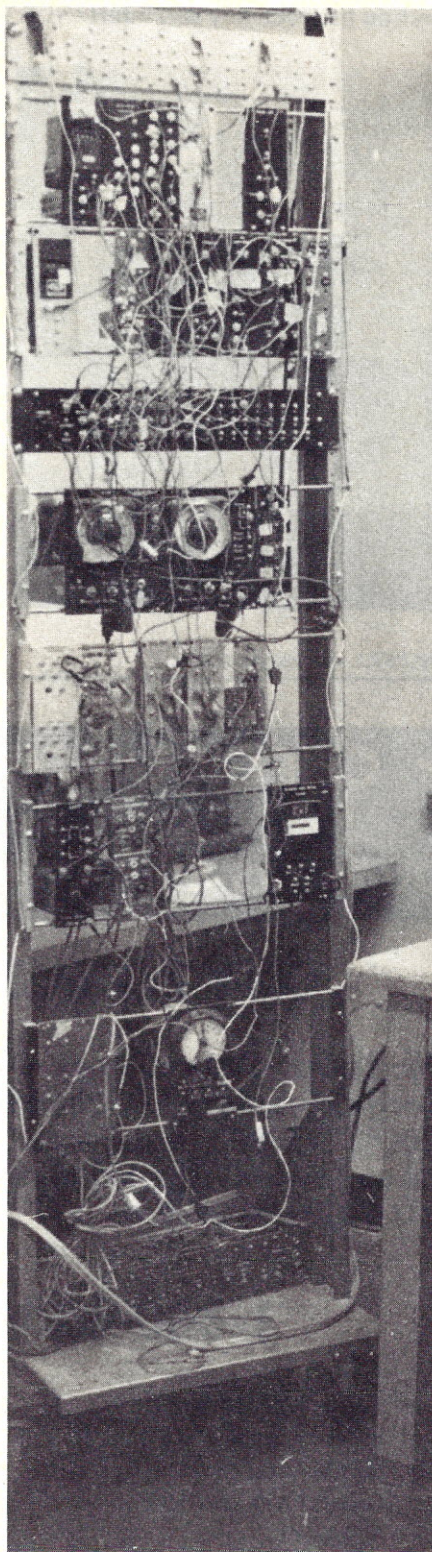


Photo 1. Electromechanical trappings required by experimental behaviorists to record animal behavior inside experimental chambers.

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formation. A clock in the interface automatically records event time with 1/60 of a second accuracy.

To simplify the PET programming task, a special set of one- and two-digit commands was devised. For example, "N1" when embedded in a print statement (PRINT#1, "N1") would turn on lamp 1, assuming that the lamp was connected to the output 1

terminal on the rear of the interface. A PRINT #1, "F1" statement turns the same lamp off.

Data (key-pecks) coming into the interface from the chamber is handled similarly. An INPUT#1, "S" statement returns to the PET the number of the key the bird pecked, again assuming the appropriate connection between key and interface. A

polling, as opposed to an interrupt, method is used to detect when a key has been pecked. This means that the PET's program must execute the INPUT#1, "S" statement at least once every 250 ms to avoid losing incoming peck data.

Even so, many statements can be executed during this interval, and the polling requirement has not yet been a drawback to executing fairly complex programs. The fact that data recording is automatic and under the control of the interface, together with the special set of control commands described above, means that the program in the PET usually occupies less than 2K of the PET's RAM, even for complicated experiments.

After an experimental session is over, the cassette tape is removed and the data is analyzed on another PET, which has a disk system to speed up the analysis. We get a hard-copy printout, store the data on disk, and erase and reuse the cassette tape for the next subject.

To date, the interface has been very reliable. Moreover, it is suitable for any animal or human experiment where the data consists of discrete responses. ■

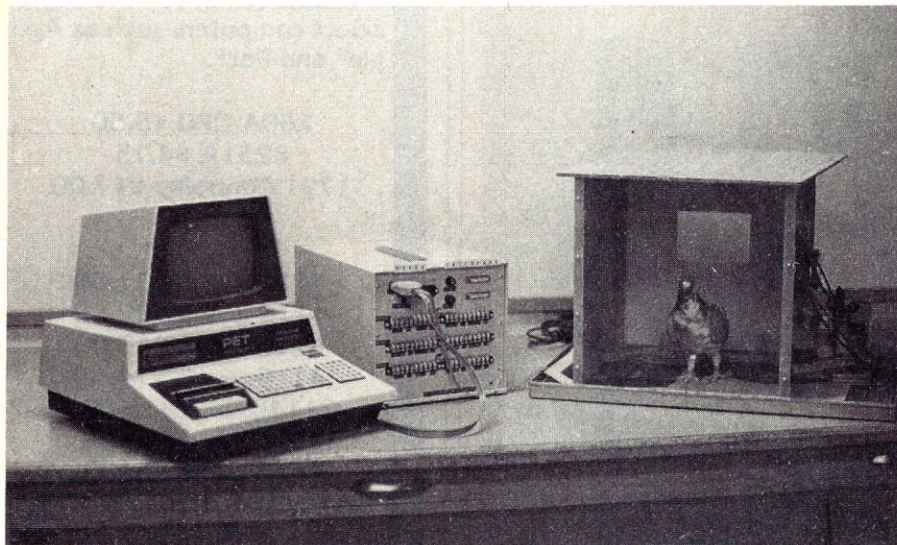
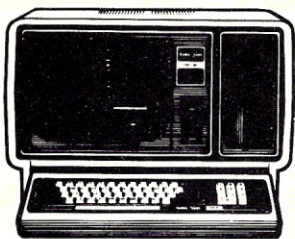


Photo 2. The interface connecting the PET to the pigeon world.

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Finely-Tuned Basic Compiler

Microsoft's Basic compiler is a quick way to increase program speed without rewriting code.

By Jon Lindsay

Microsoft's contribution to Basic is legendary. So when their Basic Compiler (BASCOM) was introduced, the computer industry looked eagerly to this new tool in hope of finding a major programming asset. What it found was a compiler that used as source code a language that was already a standard—that is, BASICOM compiles, for the most part, code identical to the code that runs with their Basic interpreter.

With some notable exceptions, BASCOM was designed to operate with the same code as Basic-80, Microsoft's latest interpreter Basic. (For a review of Basic-80, see "New Version of Basic" by Jon Lindsay in *Microcomputing*, May 1980, p. 72.) This is one of the major advantages of this compiler. The programmer can develop and execute immediately all or part (i.e., modules) of a program, using the interpreter to test it before compiling. Since the compiling pro-

cess takes several minutes, much time is saved when only a minor program adjustment is needed.

Microsoft has continued efforts to fine-tune its compiler. The most recent version of BASCOM can directly compile source code developed for Microsoft's MBasic, the earlier version of CP/M disk Basic. I and thousands of other users of the older and more widely distributed MBasic version 4.51 now have the advantage of a compiler that usually requires no modifications to the original source code. In other words, if a program executes correctly with MBasic version 4.51, it will execute correctly after being compiled by BASCOM.

This trick is more than sleight of hand—it's an ingenious and thoughtful consideration in language development that will be appreciated by anyone trying to move from one Basic to another.

There are significant differences between MBasic version 4.51 and Basic-80 version 5.0, as I pointed out in my review. MBasic lets you compress commands, statements and variables. For example,

```
10 FORX=1TO500:PRINTX,X*X:NEXTX
will run in MBasic 4.51, but not in
Basic-80 5.0. Also, the input statement
is handled differently. That is,
10 X=50
20 INPUT X (hit carriage return)
30 PRINT "X=";X
```

when run in MBasic will result in X=50 being displayed. With Basic-80 the result will print as X=0. That is, the value of X will not pass through the Input statement. You can program around this by storing X in another variable and checking to see if X=0. If so, transfer the original value back to X. To demonstrate:

```
10 X=50
20 Y=X
30 INPUT X (hit carriage return)
40 IF X=0 THEN X=Y
50 PRINT "X=";X
```

The result will be the same as the previous example.

Getting to the Source

Assuming that you have accepted the idea of a compiler, how can the source code be generated? Must you use a Basic interpreter in order to use the compiler? Well, technically, no. But the programming task would be remarkably easier if you did use an interpreter initially. You will be able to proof immediately and continually the viability of the program. Does it work the way you intended it to? Run it now on the interpreter and find out!

Whether you use MBasic 4.51 or

```
10 REM BENCHMARK
20 INPUT A
30 FOR X=1 to 10000
40 NEXT X
50 PRINT X,"Finished"
60 END
```

Listing 1. This program was created by Basic-80, but will run with all three languages.

Jon Lindsay (1001 Pacific St., Monterey, CA 93940) is a computer hobbyist and author of the recently released book, Introduction to CP/M Assembly Language.

Basic-80, the program must be saved in ASCII format to be compiled by BASCOM; any text editor that saves the text in ASCII will work. The editor, ED.COM, that accompanies CP/M is fine since it automatically saves text in the proper format.

The interpreter, however, takes on new character when considered along with the compiler. The interpreter becomes an editor with most of the excellent features of such. You can change and expand your program, editing the text line by line. Best of all, you can then run the program to see how well it works. All of this is done with one utility, the Basic interpreter. But BASCOM is all you need to get started with a working compiler.

In the CP/M version, .COM files that are directly executable from the command level of CP/M are produced as a result of two processes. First, the BASCOM compiler is used to compile the source program, resulting in a relocatable (.REL) file. The second step is to link, via L80.COM, this .REL file with essential software utilities residing on the disk. The result will be a .COM file, which can then be directly executed from CP/M command level.

Various characteristics of the source program are handled by a series of switches. These take into consideration aspects of the program that will require the inclusion of certain software functions from the compiler library during the compiling process.

Inclusion of this additional software modifies the object file; it may become larger or somewhat slower in execution as a result of the added code. So, where file size is a consideration, you can write source code to minimize the compiled object code size, but at the expense of convenience. Normally, however, you would probably want to use the full strength of the compiler, which includes most of the powerful functions of the Basic interpreter. Examples of these switches follow:

- /E — tells the compiler that the program contains the On Error Goto statement.
- /X — the program contains one or more Resume, Resume Next or Resume 0 statements. The /E switch is assumed when the /X switch is used.
- /N — prevents listing of the generated code in symbolic notation.
- /D — causes the debug code to be generated at runtime. Used with program TRON/TROFF, this switch will check

for arithmetic overflow, the array bounds, supply line numbers that indicate location of runtime errors. Also, Return is checked for its associated Gosub.

- /Z — forces the compiler to write long quoted strings to the binary file, thus saving memory. Two disadvantages to this switch are 1) identical long quoted strings will waste memory, 2) compiled code generated with this switch set cannot be placed in ROM.
- /4 — allows use of MBasic version 4.51 lexicon. That is, spaces are insignificant, embedded reserved words in variables are illegal, variable names are significant only to two characters.
- /C — will allow a program without line numbers to be compiled. Targets for Goto and Gosub statements must have line numbers. Note: switches /C and /4 cannot be used together.
- /T — allows more version 4.51 conventions. For example, For/Next loops are always executed at least once and the Input statement will pass a variable's previous value, even though only a carriage return is entered.

Using BASCOM

If your program was generated with an editor, it was probably automatically saved as an ASCII file. If you used Basic-80 or MBasic 4.51, you have saved the program using the ASCII switch A in the statement SAVE "program name".A

In this form, BASCOM can properly operate on the source code.

Basic-80 version 5.0 was used to generate Listing 1. As it stands, it should also run in MBasic with correct results. Listing 1 will also be used as a benchmark to compare execution time of MBasic 4.51, Basic-80 and BASCOM. Having saved it in ASCII, the compiling procedure could be as follows. Remember that the object of this exercise is to arrive at a .COM file that can be directly executed from CP/M command level.

Refer to the list of compiler switches, and be sure to include only those which apply. Since the code is not unique to MBasic 4.51, you won't need switches /4 or /T. Likewise, since no Resume or Error statement is present, switches /X and /E are not used. If any or all of the above switches were used, probably the only penalty would be some extra code in the object file. The program would still execute properly and at high speed.

Assuming an 8080 CPU, the /Z switch will also be excluded. We are left with no compiler switches. So, to compile Listing 1, type BASCOM = BENCH

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Note the space between BASCOM and =.

This procedure will result in the production of a file named Bench-REL on the disk currently being used. This must now be linked by the Link-80 program that comes with the BASCOM package, to tie the on-board software routines needed by the program with the program itself. The result will be a .COM file. In our current example, type

L80 BENCH,BENCH/N/E

Again, note the space between L80 and the first Bench.

Note that Link-80 is using a different, though just as important, set of switches than the compiler. Here the switch /N will cause the program named Bench to be saved on the logged disk as a .COM file. The switch /E will cause the program to exit Link-80 and return to the CP/M operating system. Before exiting, however, three numbers will be printed: the start address, the address of the next available byte, and the number of 256-byte pages used. And that's it! Examine your directory and you should find a program called Bench.COM. Simply type BENCH to execute the program.

Numerous switches must be contended with during the compiling process. Most programs will probably be compiled as I've described. If you want to compile (test) (but not save, rename, relocate on another disk, etc.) the object code, see the various techniques that are clearly defined in the documentation.

What if you are using the MBasic format, as in Listing 2? The procedure is similar except for adding appropriate switches.

Look at Listing 2; besides the compressed lines, the Error and Resume

statements are used. In such a case, switch /X would be used. Switch /E is automatically set when the /X switch is specified. And since you are using a Z-80 microprocessor, you might want to use that switch in order to get a more efficient object code. Putting it all together, the program would be compiled as follows:

BASCOM =COUNT/T/4/X/Z

Once compiled, employ the linker in the same manner as before. That is,

L80 COUNT,COUNT/N/E

Apples and Oranges

When the word *benchmark* is used, it usually refers to program execution speed, but it can be misleading because it doesn't always consider the total language capability. Comparing execution speeds alone will not give insight into the degree of difficulty in programming in those languages.

Speed is important, but so is programming ease. Can anyone deny that an assembly-language program can count to 10,000 faster than it can be run through an interpreter? Yet the difficulty of working with assembly language is significantly greater than with an interpreter.

So, forewarned, let us do a benchmark, using Listing 1 as our source. Many, if not most, of the capabilities of MBasic, Basic-80 and BASCOM are not demonstrated. In this case, however, one common program will be used, though it's probably not optimized for each language. This brings us closer to a valid comparison. For the result see Table 1.

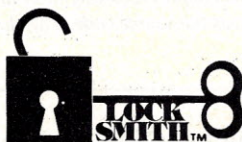
If you are fortunate to have all three languages residing on your disk, note the size of each. BASCOM's size is not important as such since it is not the final product.

```

10 REM COUNT.BAS
20 ON ERROR GOTO 80
30 FORX=50TO0STEP-1
40 PRINT X,
50 PRINT USING "####.##";1000/X
60 NEXTX
70 GOTO110
80 IF ERR=11 THEN PRINT "ERROR TRAP HERE"
90 FOR Y=1TO500:NEXTY
100 RESUME 30
110 PRINT "END OF PROGRAM"
120 END
  
```

Listing 2. MBasic 4.51 lexicon is used. Both the Resume and Error statements are used. In line 80 ERR=11 is the error code number for "division by zero." Line 90 is a simple delay. The program never reaches line 110.

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What surprised me is the amount of software luggage that accompanies a program. Listing 1 resides on disk in the minimal allotted CP/M disk space—1K bytes of memory. MBasic takes up 18K and Basic-80, with its expanded features, occupies 24K. So the approximate amount of memory required to execute Listing 1 in MBasic is 19K, in Basic-80 is 25K, and in the compiled form of Bench is 10K.

Compilers do give your program a lot of baggage to carry. Whereas one interpreter will operate many different programs, compilers make each program carry its own computing equipment.

Taking five 1K programs to illustrate, the compiled five programs would result in .COM files of probably 10K each. Thus, 50K of disk space would be needed to contain five such programs. If the interpreter were used, the disk space cost would be 5K plus the size of the interpreter (e.g., 24K). So, compiling results in a fast-filling disk. Nevertheless, the increased execution speed is usually worth the space.

At this point you might think BASCOM is a compiler that will compile anything and run, but such is not

the case. Remember that the final operator is that of the compiler. That it agrees so well with MBasic or Basic-80 is what makes up some of its magic. Many of the newer features found in Basic-80, but excluded from MBasic 4.51, are also found in BASCOM, and you certainly should take advantage of them.

Certain features, as of this writing, are not yet implemented in the compiler; for example, the Common statement, which is designed to allow the passing of variables from one program to the next. You can chain programs, but only in the simplest form. The %Include statement, on the other hand, is now implemented to allow compiling of source code outside (i.e., residing on disk) the program to be compiled.

As with any good language, a long list of error messages is included to indicate to the user certain fault conditions as they occur. These are well documented, as are the other features of the compiler.

Documentation for Basic-80 is included along with operational guides for the compiler, since the two are basically the same; BASCOM was designed around the Basic-80 interpreter.

Language	Time
BASCOM	11 seconds
MBasic ver.4.51	21 seconds
Basic-80 ver.5.2	23 seconds

Table 1. Benchmark results of three languages. Listing 1 was the source code. The clock speed is 2 MHz.

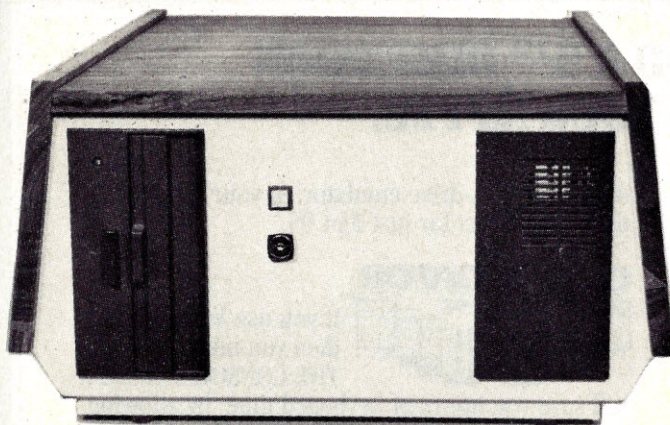
ter. While BASCOM might not have all the features of Basic-80, it is nonetheless complete enough to satisfy most of us.

Summary

In an effort to assimilate both form and content, Microsoft has enhanced its Basic compiler to accept not only Basic-80, but also MBasic version 4.51, as proper source code. Although popular editors can be used, by using one of the interpreters, you can test the program as it is developed.

Also, previously debugged programs can usually be compiled directly to remarkably increase execution speed. BASCOM gives new dimension to Basic that is sure to increase throughput and efficiency of any program. ■

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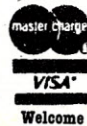
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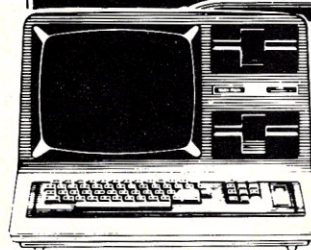


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Data Loader For the S-100

This easy-to-use, inexpensive data loader circuit requires no memory space and plugs directly into your S-100 computer.

By Stuart Ball

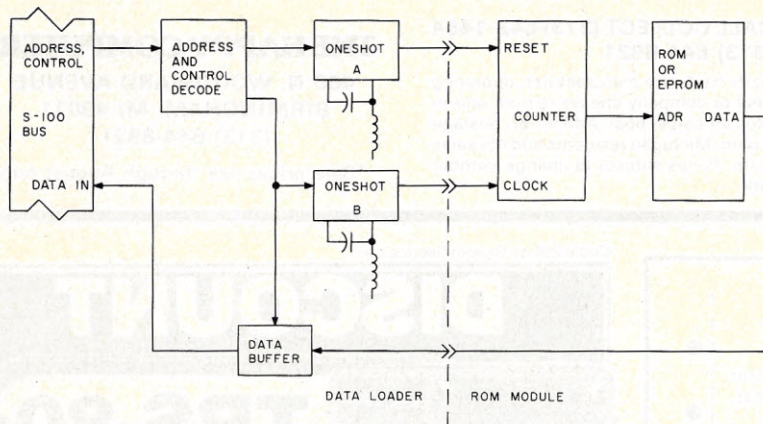


Fig. 1. S-100 data loader block diagram.

This circuit will let you load ROM-based monitors, operating systems, Basic interpreters, disk bootstrap programs, program data, data encryption codes or any other data that can be programmed into a ROM or EPROM, all without removing the cover of your S-100 computer. This data loader uses only one I/O port, and no memory space in the machine.

Theory of Operation (refer to Fig. 1): When an output to the port is executed, one-shot A toggles, resetting the

*Address correspondence to Stuart Ball, 1101
Dover St. NE, Cedar Rapids, IA 52402.*

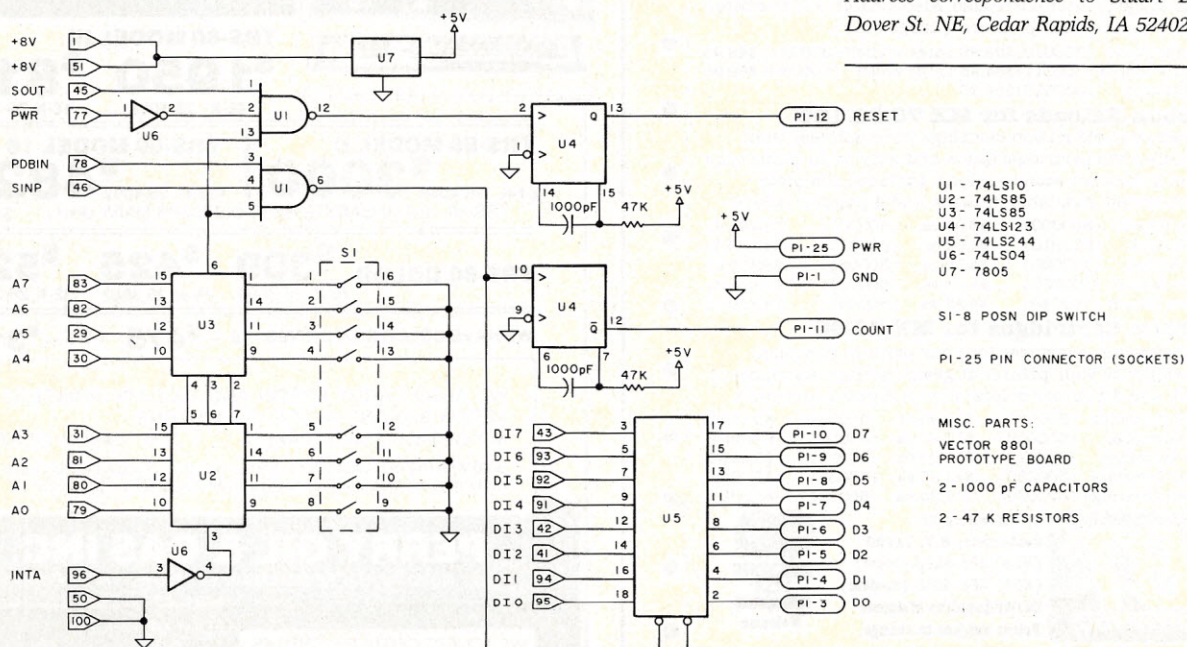


Fig. 2. S-100 data loader schematic.

counter on the ROM module. After each input from the port, one-shot B toggles, incrementing the counter on the ROM module and addressing the next location in the ROM.

I/O Port Selection (refer to Fig. 2): Switch S1 is used to select the I/O address of the data loader. ICs U2 and U3 are comparators that produce a high output when the address inputs (A0-A7) match the switch inputs. A closed switch is a 0; an open switch is a 1.

About the Circuit (refer to Fig. 2): ICs U2 and U3 are address comparators that produce a high output when the selected address is at A0-A7 and when INTA is low.

When an input from the selected port occurs, U1 pin 6 goes low, enabling U5. When U1 pin 6 returns high, U4 pin 12 is triggered, incrementing the counter on the ROM module.

Purists might want to pull up the B inputs to U2 and U3 with resistors, but I did not feel that this was necessary. I have yet to experience any problems from having these inputs floating. In fact, the biggest problem with this circuit seems to be finding other useful functions to fill the rest of the S-100 prototype board (I put on RAM).

About the ROM Module (Fig. 3): The ROM module shown is for a pair of

2K by eight-bit 2716 chips, but can be easily expanded to any size. For small (2K to 6K byte) memories, the entire module can be placed in a housing attached to the 25-pin connector. This is especially useful for data encryption and other privileged information, as the module can be locked in a safe or other secure location when not in use.

The ground connection to the shell of the connector is important, as it en-

sures that any static charge on the module is discharged to the computer frame when the module is plugged in.

Loader Program

The program shown in the listing will load memory from 0000 to 0FFF (hexadecimal) from the ROM module, and then begin execution at location 0000. Incidentally, the program can be shortened to 16 bytes if the Z-80 INIR instruction is used. ■

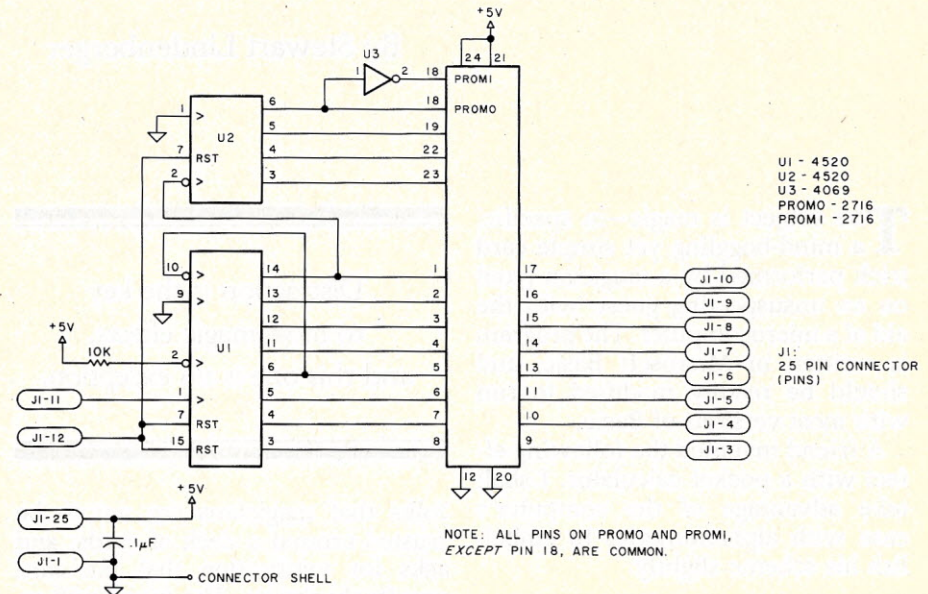


Fig. 3. 4K ROM module.

```

00001
00002
00003
00004
00005
00006
00007
00008
00009
00010
00011      0066      PORT      EQU 66H
00012      1000      LENGTH    EQU 1000H
00013      0000      START     EQU 00H
00014
00015
00016      1000      >         ORG 1000H
00017      1000      D366      OUT (PORT),A
00018      1002      210000    LD HL,START
00019      1005      110010    LD DE,LENGTH
00020      1008      DB66      LOOP  IN A, (PORT)
00021      100A      77        LD (HL),A
00022      100B      23        INC HL
00023      100C      1B        DEC DE
00024      100D      7A        LD A,D
00025      100E      B3        OR E
00026      100F      C20810    >      JP NZ,LOOP
00027      1012      C30000    JP START
00028

```

PROGRAM TO LOAD 4K OF CODE FROM THE DATA LOADER PORT (PORT 66H) AND THEN EXECUTE IT

EQUATES

ADDR OF DATA LOADER

BYTES TO LOAD

START ADDR OF MEM TO LOAD

START OF CODE

PROG STARTS ABOVE LOADED MEM

CLEAR DATA LOADER COUNTER

START ADDR OF MEM TO LOAD

BYTES TO LOAD INTO DE

LOAD BYTE FROM D.L.

LOAD BYTE INTO MEM

INCR MEM POINTER

DECR LENGTH

SEE IF DE IS ZERO

CONTINUE LOOPING

BRANCH TO LOADED CODE

Program listing.

Alphanumeric Abracadabra

When it's time for party games, your micro can add to the fun.

By Stewart Lindenberger

The subject is magic—in specific, a mind-boggling yet simple card trick performed by a magician (you) on an unsuspecting guest, with the aid of a microcomputer. The program is written in Microsoft Basic, and should be readily modified to run with most versions of Basic.

A friend invented the following effect with a pocket calculator. I shall take advantage of the computer's ease with alphanumerics to embellish his scheme slightly.

The Scene

Let's say you're having a party; a small group of good friends have gathered for some conversation and good times. At some point in the evening, you announce that you'd like to demonstrate a rather remarkable feat performed by your microcomputer. Have them gather around the system, fire it up as quickly as you can, and type in the proper command to load the program. But hold up on the carriage return.

Then, explain that the computer printer malfunctioned the other day, and produced this rather unusual deck of playing cards. At this point, pretend to pick up a deck of cards. Make it appear to be slightly larger and heavier than an ordinary deck. Tell them that you checked the cards, and to your surprise, the deck was complete. Then have some fun handing the deck to someone, and ask him to carefully shuffle. Have someone spread them out, and someone else pick one. Ask that person to announce the name of the card to the group, to state that it was freely chosen, and then to sit down at the keyboard and hit the return key.

The system begins by warning the

Distraction is the key
to most magic effects,
and this one is no exception.

folks that magicians are not to be trusted around a deck of cards, and asks for verification that the card was freely chosen. The friend will require slight prompting from you to respond to the questions it will ask him (for example, tell him to type YES to answer the first one). The computer then proceeds to ask your friend, in a rather whimsical way, ARE YOU FEMALE?, ARE YOU MARRIED?, ARE YOU LEFT-HANDED? and finally DO YOU PREFER BLONDES?, while your guest provides the answers (truth or not as he sees fit).

The computer asks, WAS YOUR CARD RED? This question must be answered honestly. It then asks for patience while it ponders the guest's personal profile, and a series of stars marches diagonally across the screen. Then with fanfare the machine displays the name of the card that had been chosen. It really does. And it happens exactly as stated. You don't do any sly typing, or even have to touch the machine, at any point during the procedure. And yet it works.

How It Works

Distraction is the key to most magic effects, and this one is no exception. The computer distracts the audience from the simple encoding which you

perform, via prompting your friend with the answers to the questions at the terminal. Actually, he is typing in a binary-coded decimal (8421) representation of the chosen card. Such great deception!

The code is indeed simple, and should be easy to master.

First determine the numerical equivalent of the card, if it happens to be a face card (Jack = 11, Queen = 12, King = 13, Ace = 1 and Joker = 0). Next, turn it into a binary 8-4-2-1 number. For example, 5 = 0-1-0-1 and 11 = 1-0-1-1. This binary code tells which questions are to be counted (answered with *other* than yes or no), and which questions are not counted (answer with yes, yea, y, or no, na, naw, n, etc.). The questions have the 8-4-2-1 values in their sequence. The first question is worth 8 if it is answered with some words, again, other than yes, no, ya, etc. The second is worth 4; the third, 2; the last, 1. Thus, at the end of four questions, the computer knows the value of the card.

The neat feature is that the lie/truth aspect of your friend's answer helps hide your code by distraction. Have him tell you whether he wishes to lie to any question, and help him do it. For example, the marriage question is #3 in the sequence, and thus it would be worth 2 to the total count if it were counted. If the person is single, and if the card required that the question be counted, and the person wishes to lie, tell him to type married, or hitched (or any other answer that doesn't begin with y or n). And

Address correspondence to Stewart Lindenberger, RD 1, Box 44, Somerset, NJ 08873.

so on for all four questions.

Now for the suit. By this time the audience is used to your prompting and shouldn't be suspicious of this one. The key: if the card is hearts, the answer should be RED; if diamonds, the answer is YES; if spades, BLACK; if clubs or joker, answer NO. That's it.

I've included a sample magic session. Of course, you may modify the questions to suit your taste or audi-

ence. The purpose of requiring YES as an answer to the first question is to get your audience used to your intervention with the answering process, and to make it appear that your assistance is innocuous and merely required to help the typist deal with the peculiarities of your system. ■

The author wishes to thank Doug Schmidt.

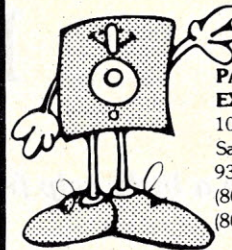
```
A>TYPE MAGIC.ASC
10 PRINTCHR$(12):PRINT:PRINT:PRINTTAB(10);"WELCOME . . .":PRINT:PRINT
20 PRINT"I ASSUME THAT YOUR ";
30 PRINT"HOST HAS ALREADY HAD YOU CHOSE A CARD . . . "
40 PRINT:PRINT"DON'T PROCEED UNLESS YOU FEEL THAT YOUR SELECTION WAS"
50 PRINT"MADE WITHOUT ANY INTERFERENCE OR INFLUENCE BY HIM.";
60 PRINT" I GIVE"
70 PRINT"YOU THIS WARNING BECAUSE I KNOW THAT ";
80 PRINT"MAGICIANS ARE ABLE TO WORK"
90 PRINT"WONDERS UPON THE UNSUSPECTING OR UNINITIATED ";
100 PRINT"WITH A DECK OF CARDS."
110 PRINT:PRINT"SO, IF YOU HAVE ANY DOUBT ABOUT THE CARD YOU SELECTED,"
120 PRINT"FEEL FREE TO MAKE ANOTHER SELECTION BEFORE WE GO ANY FURTHER."
130 INPUT "ARE YOU READY";A$
140 IF A$<>"YES".THEN PRINT:PRINT"OK, I'LL WAIT ...":PRINT:GOTO 130
150 PRINTCHR$(12):PRINT:PRINT:PRINT"GOOD... HERE WE GO: "
160 PRINT:PRINT:PRINT"I NEED TO KNOW SOMETHING ABOUT YOU"
170 PRINT"PLEASE DON'T BE OFFENDED...";
180 PRINT" AND REMEMBER, HONESTY IS PREFERRED "
190 PRINT" (COUGH COUGH) ..."
200 PRINT:PRINT"I WON'T TELL ANYONE ELSE WHAT YOU TELL ME. IN FACT, I"
210 PRINT"PROMISE TO FORGET IT AS SOON AS WE ARE DONE...":PRINT:PRINT
220 PRINT"FIRST QUESTION IS RELATED TO *** SEX ***"
230 PRINT:PRINT:INPUT "ARE YOU FEMALE ";A$
240 V=0:IFLEFT$(A$,1)="Y" OR LEFT$(A$,1)="N" THEN 260
250 V=8
260 PRINT:PRINT:INPUT "OK, ARE YOU LEFT HANDED ";B$
270 IF LEFT$(B$,1)="Y" OR LEFT$(B$,1)="N" THEN 290
280 V=V+4
290 PRINT:PRINT"WE'RE DOING GREAT . . ."
300 PRINT:INPUT "ARE YOU MARRIED ";C$
310 PRINT:PRINT" . . . THAT'S A SHAME":PRINT
320 IF LEFT$(C$,1)="Y" OR LEFT$(C$,1)="N" THEN 340
330 V=V+2
340 PRINT:INPUT "DO YOU PREFER BLONDES ";D$
350 IF LEFT$(D$,1)="Y" OR LEFT$(D$,1)="N" THEN GOTO 370
360 V=V+1
370 PRINT:PRINT"... HMM, PERHAPS I SHOULD CHANGE MY INSULATION,";
380 PRINT" I'M TIRED"
390 PRINT"OF BLUE WIRES...":PRINT:PRINT"OH WELL, LET'S CONTINUE ";
400 PRINT"(I'M ALMOST DONE"
410 PRINT"WITH THIS PERSONAL PROFILING)...";
420 PRINT"ACTUALLY, SINCE COLOR WAS THE LAST TOPIC, WAS YOUR CARD RED? "
430 INPUT "(PLEASE BE HONEST WITH THIS ONE)";F$
440 IF LEFT$(F$,1)="R" THEN S$="HEARTS"
450 IF LEFT$(F$,1)="B" THEN S$="SPADES"
460 IF LEFT$(F$,1)="Y" THEN S$="DIAMONDS"
470 IF LEFT$(F$,1)="N" THEN S$="CLUBS"
480 IF V<11 AND V>1 THEN Z$=STR$(V)
490 IF V=11 THEN Z$="KNAVE (JACK)"
500 IF V=12 THEN Z$="QUEEN"
510 IF V=13 THEN Z$="KINK"
520 IF V=1 THEN Z$="ACE"
530 IF V=0 AND LEFT$(F$,1)="N" THEN Z$="JESTER"
540 PRINTCHR$(12):PRINT:PRINT:PRINT:PRINT:PRINTTAB(6);
550 PRINT"PLEASE STAND BY WHILE I THINK ABOUT WHAT YOU HAVE TOLD ME"
560 A=20
570 FOR I=1 TO 30
580 GOSUB 740
590 PRINTTAB(I);""
600 NEXT I
610 PRINT:PRINT:PRINT:PRINT:
620 PRINT:PRINT"TA TA TA TA TA TA (FANFARE) ....."
630 PRINT:PRINT:PRINT
640 PRINTTAB(20)"YOUR CARD WAS THE ";Z$;
650 IF LEFT$(Z$,1)<"J" THEN PRINT " OF ";S$;" I"
660 PRINT:PRINT:PRINT:PRINT" SO . . O . . O O O O O ... "
670 PRINT:PRINT
680 PRINT:PRINT" JUST GOES TO SHOW YA ,";
690 PRINT"US COMPUTERS AIN'T AS DUMB AS WE LOOK!":PRINT
700 PRINT"(HOPE I WAS RIGHT)"
710 PRINT:PRINT" SEE YA AROUND KIDDO!":PRINT:PRINT
720 END
730 REM .... THIS IS A WASTE TIME LOOP !
740 FOR M=1 TO A:W=2.31/.85:NEXT
750 RETURN
```

Program listing. A little bit of magic in Microsoft Basic.

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*With a little help from your micro, you can keep ahead of the tax collector
... by paying up on time.*

By Gene Embry

The 16th Amendment to the U.S. Constitution, passed in 1913, permits the federal government to tax personal incomes. Since then, we've developed the most complex and confusing set of tax laws in the world. On page 187 of Publication 334, "Tax Guide for Small Business," is a table called Commonly Used Tax Forms. It lists 85 forms! Compared to the employer, the employee has it fairly

easy. Once the employer deducts the taxes from his workers' paychecks, he must get the money to the government. Not only must he file the reports and make the money deposits, but he must also be timely. In other words, he has to do things when the Internal Revenue Service (IRS) says.

For example, if the amount of taxes due is over \$200 but less than \$2000

and the month is the first or second of the quarter, then the employer must deposit the taxes within 15 days after the end of the month. If it is the last month of the quarter, then he must deposit the taxes by the end of the next month. Sometimes, if he's made timely deposits, he's allowed an extra ten days to file his reports. But the money must still be deposited on time.

Failure to make timely deposits results in a stiff penalty. A friend of mine who runs a small business with only 14 employees recently paid a \$600 penalty because his overworked bookkeeper failed to make timely deposits.

This program helps ease some of the burden on the employer and the many CPAs and bookkeepers who handle payroll accounts. It provides timely information regarding the when and the how much of deposits. The various forms that must be filed are also printed for your reference.

The program is an example of a possible solution to a problem. Any damage, financial ruin or federal lawsuits resulting from the use or misuse of this program is your responsibility. I strongly recommend that you con-

Account #	Description
205	Social Security Tax—FICA
206	Federal Income Tax
207	State Income Tax
208	State Unemployment Tax
209	Federal Unemployment Tax—FUTA

Table 1. The payroll liability accounts considered by *LIABLE.TAX*.

Form Number	Form Name
SS-8	Information for Use in Determining Whether a Worker is an Employee for Purposes of Federal Employment Taxes and Income Tax Withholding (GOOD GRIEF!)
W-2	Wage & Tax Statement
940	Employer's Annual Federal Unemployment Tax Return
508	Record of Federal Tax Deposits for Unemployment Tax
941	Employer's Quarterly Federal Tax Return
501	Record of Federal Tax Deposits for Income & FICA Taxes

Table 2. Forms needed by employers during the course of a year.

Address correspondence to Gene Embry, Route 1 Box 151-H, Morrisville, NC 27560.

sult the most recent issue of Circular E, which is available from the Department of the Treasury, Internal Revenue Service.

Assumptions

I wrote this program on a 6800 micro with Smoke Signal Broadcasting's disk operating system and Computerware's Basic. My system includes 32K of memory, a video terminal, printer and dual eight-inch drives.

I assume you run your payroll on your microcomputer and you have a chart of accounts that stores the

various liabilities that result because you pay your employees. The liability accounts needed are federal income withholding taxes, federal unemployment taxes (FUTA) and social security (FICA) taxes. Other accounts may be needed for state, county and city income taxes.

You may also require accounts for other types of taxes, such as sales taxes, inventory and unemployment. And you mustn't forget other liabilities, such as union dues, uniforms, insurance, United Givers Fund and savings plans. I assume you have a corresponding account number for

Variable	Description
M	The number of the month of the year
Q	Output device number
T	Total of all liabilities
V	Selects the record number of the parameter file
V1	End of quarter flag—Equals zero if end of quarter
Z	Amount of taxes owed for liability under consideration
C\$	Name of this month
M\$	Name of next month
N\$	Company name
O\$	Today's date
P\$	Report Title
R\$	Special message based on today's day
X\$	Description of the liability under consideration
FS()	Array to hold the number of the forms
MS()	Array to hold the various messages

Table 3. Some significant variables used in the program *LIABLE.TAX*.

Payroll Liability Status Report				
SuperSoftware, Inc.				
AS OF: December 2, 1981				
Tax Burden	Account Number	Amount of Liability	Comments	Use Form
Federal-Fica & w/h	205 & 206	\$ 2075.73	Deposit due within 3 banking days after the 7th Report due last day of January	501
			Report due last day of January	940
			Report due last day of January	941
F.U.T.A.	208	\$ 103.75	Deposit due last day of January	508
S.U.T.A.	208	\$ 100.40	Deposit due-Report due last day of January	MCUI-101
			Deposit due-Report due last day of January	MCUI-625
State w/h	207	\$ 456.88	Deposit due-Report due on the 15th of January	MC-5
Reminder --W-2's due last day of January				
Total liability		\$ 2736.76		

Payroll Liability Status Report				
SuperSoftware, Inc.				
AS OF: February 20, 1982				
Tax Burden	Account Number	Amount of Liability	Comments	Use Form
Federal-Fica & w/h	205 & 206	\$ 2075.73	Deposit due within 3 banking days after the 22nd	501
F.U.T.A.	208	\$ 103.75	No deposits due	
S.U.T.A.	208	\$ 100.40	No deposits due	
State w/h	207	\$ 456.88	Deposit due-Report due on the 15th of March	MC-5
Total liability		\$ 2736.76		

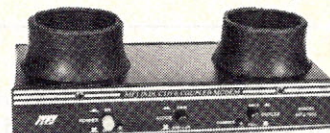
Example. Two printouts of the program *LIABLE.TAX*. Differences are due to changing the current date.

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MFJ ENTERPRISES, INCORPORATED
921 Louisville Road, Starkville, MS 39759

Amount of Tax	End of Quarter	Action Required
< 200	No	No deposit required
< 200	Yes	Deposit at end of next month
200-2000	No	Deposit within 15 days after end of this month
200-2000	Yes	Deposit at end of next month
> 2,000	No	Deposit within 3 banking days after the 7th, 15th, 22nd or last day of the month
> 2,000	Yes	(Same as above)

Table 4. This table was used to write the conditional coding of lines 2000-2080. It tries to answer the question, "Do I need to make a federal tax deposit?"

each liability. I assume you are a North Carolina Tar Heel and pay taxes according to our tax laws. Finally, I assume the accounts are stored in file Chart.DAT, in ascending order by account number. This lets you use the binary search routine to quickly find the accounts and current liabilities.

Table 1 lists the account numbers and a description of the liability items I'll use for this program. Table 2 lists some of the federal forms required at various times during the year.

The global variables are stored in a system parameter file, MASTER.DAT. The variables needed for this program are described by the comments and remarks section of

the program, LIABLE.TAX, and in Table 3.

Overview

The problem is simple when broken down into the individual parts. You first determine the amount of each current liability. You then report what you need to do and when, based on today's date and the amount of the liability. The initialization of the variables in lines 9800 to 9899 is important since the timeliness of the deposits and reports is a function not only of the amount owed, but also of which month of the quarter and which day of the month the wages are paid.

Note the variable M in line 9812

and how it is manipulated during this section. This variable is stored as an eight-digit number and is formatted as YYYYMMDD. This is today's date in descending order by time periods. Each of the first 12 records of the file MASTER.DAT contains the name for the months of the year in the string variable.

The comments printed on the report are concatenations of the message array M\$(x) and the forms array F\$(x). You may change them to suit your needs.

The program, LIABLE.TAX, requires about 6500 bytes of memory, with an additional 2000 bytes required for the variables. The example shows a sample run.

Program Theory

Following the call to the routine starting at line 9800 to initialize the global variables, we call the routine at line 1000 that obtains the current liabilities from the file Chart.DAT. We then determine which port to use for the output by calling the routine at 8100. We force the output to the video terminal if the printer is not selected. We then print the header for the report by calling the routine at 8200.

The section of code from lines 200 to 399 is executed sequentially by calling the appropriate routines. These routines test the amount of taxes owed and report if we need to pay them.

Table 4 is a write-up of the various conditions that must be tested after you've determined the sum of the federal withholding income taxes and the FICA taxes. The coding from lines 2000 to 2090 prints out the necessary information based on my interpretation of the rules found in various federal publications. If additional liabilities or forms are required, you should be able to write the necessary code after you construct the proper truth tables for the liability under consideration.

Conclusion

This program may be expanded or modified for your needs. Note that a complete record is read from a random file each time a call is made to perform a read operation. If you need more information regarding the exact nature of the parameter file or the chart of account file, you should review my article in the January 1981 issue of *Microcomputing* ("A Minimum Accounting System," p. 135). ■

Program listing. 6800-based LIABLE.TAX program.

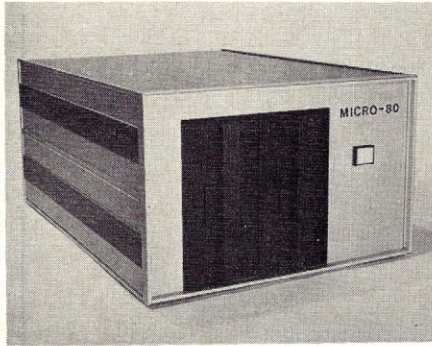
```

0001 : :   LIABLE.TAX
0002 : :
0003 : :   Gene Embry
0004 : :
0010 HOME
0020 PRINT "Payroll Liability Status Report - Gettings Data"
0030 GOSUB 9800::Get program variables
0099 : :
0100 : Set up
0101 : :
0110 GOSUB 1000::  Get liabilities
0199 : :
0200 : Main program
0201 : :
0210 GOSUB 8100::   Get output port
0230 GOSUB 8200::   Print the header of the report
0250 LET X$ = "Federal-fica & w/h"
0252 GOSUB 2000::   Test FICA & Federal withholdings taxes
0270 LET X$ = "F.U.T.A."
0272 GOSUB 3000::   Test for FUTA due
0290 LET X$ = "S.U.T.A."
0292 GOSUB 4000::   Test for State Unemployment taxes due
0310 LET X$ = "State w/h"
0312 GOSUB 5000::   Test for State income tax withhold
0320 IF M = 1 PRINT #G,"Reminder -->";F$(9); " due ";M$(4);" ";C$
0322 IF M = 12 PRINT #G,"Reminder -->";F$(9);" due ";M$(4);" ";M$
0382 LET L$ = " :GOSUB 8900::  Underline
0386 DIGITS= 2;RJUST = 5
0388 PRINT #G,"Total liability";TAB(22);" $ ";T
0390 IF G <> 1 THEN SKIP #G,10::  Print bottom border on printer
0399 : :
0900 : Done
0901 : :
0910 DIGITS= 0;RJUST = 0
0920 IF G = 1 then 990
0930 PRINT #G,ESC(91);CHR$(49);CHR$(119)::Reset printer to 10 cpi
0990 END ::  Insert a call to your master menu program
0999 : :
1000 : :   Get current tax liabilities from CHART.DAT
1001 : :
1010 LET N = 205;GOSUB 8000;L0 = C::  FICA
1012 LET N = 206;GOSUB 8000;L1 = C::  FED. W/H

```

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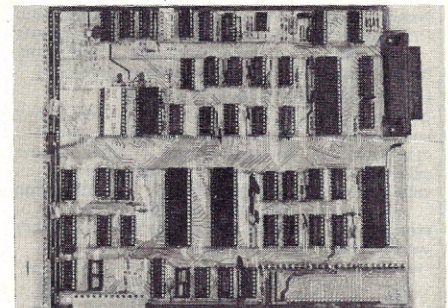
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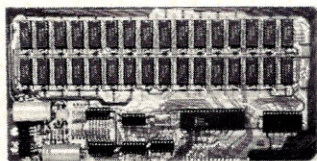
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Listing continued.

```

1014 LET N = 207:GOSUB 8000:L2 = C:: STATE W/H
1016 LET N = 208:GOSUB 8000:L3 = C:: SUTA
1018 LET N = 209:GOSUB 8000:L4 = C:: FUTA
1020 LET T = L0 + L1 + L2 + L3 + L4:: Total of all liabilities!!
1080 CLOSE #10
1090 RETURN
1098 :
2000 : : FICA & Federal withholdings tax
2001 :
2010 PRINT #G,X$:TAB(Z1);"205 & 206";
2012 LET Z = L0 + L1:: Federal taxes due
2014 RJUST= 5
2016 DIGITS= 2:PRINT #G,TAB(Z2);"% ";Z::DIGITS=0
2018 :
2020 : Deposits due?
2022 :
2028 IF Z >= 2000 PRINT #G,TAB(Z3);M$(1);" ";M$(3);" ";R$:TAB(Z4);F$(3)
2030 IF Z >= 200 IF Z < 2000 IF V1 = 0 THEN PRINT #G,TAB(Z3);M$(1);" ";M$(4);" ";M$:TAB(Z4);F$(3)
2032 IF Z >= 200 IF Z < 2000 IF V1 < 0 THEN PRINT #G,TAB(Z3);M$(1);" ";M$(2);" ";M$:TAB(Z4);F$(3)
2034 IF Z < 200 IF V1 < 0 THEN PRINT #G,TAB(Z3);M$(6)
2036 IF Z < 200 IF V1 = 0 THEN PRINT #G,TAB(Z3);M$(1);" ";M$(4);" ";M$:TAB(Z4);F$(3)
2048 :
2050 : Check for 940 and 941 reports
2052 :
2054 IF M = 1 THEN PRINT #G,TAB(Z3);M$(7);" ";M$(4);" ";C$:TAB(Z4);F$(1)
2056 IF M = 1 THEN PRINT #G,TAB(Z3);M$(7);" ";M$(4);" ";C$:TAB(Z4);F$(2)
2068 IF V1 < 0 THEN 2088::No 941 report due
2070 PRINT #G,TAB(Z3);M$(7);" ";M$(4);" ";M$:TAB(Z4);F$(1)
2072 PRINT #G,TAB(Z3);M$(7);" ";M$(4);" ";M$:TAB(Z4);F$(2)
2082 :
2088 RJUST= 0
2090 RETURN
2098 :
3000 : : Federal Unemployment Tax
3001 :
3010 PRINT #G,X$:TAB(Z1);"209";
3012 LET Z = L4 :: FUTA tax
3014 RJUST= 5
3016 DIGITS= 2:PRINT #G,TAB(Z2);"% ";Z::DIGITS=0
3018 :
3020 : Deposit?
3022 :
3030 IF M = 1 PRINT #G,TAB(Z3);M$(1);" ";M$(4);" ";C$:TAB(Z4);F$(4):GOTO 3088
3032 IF M = 1 PRINT #G,TAB(Z3);M$(1);" ";M$(4);" ";C$:TAB(Z4);F$(4):GOTO 3088
3034 IF V1 < 0 PRINT #G,TAB(Z3);M$(6):GOTO 3088
3036 IF Z <= 100 PRINT #G,TAB(Z3);M$(6)
3050 IF V1 = 0 IF Z > 100 PRINT #G,TAB(Z3);M$(1);" ";M$(4);" ";M$:TAB(Z4);F$(4)
3088 RJUST= 0
3090 RETURN
3098 :
4000 : : State Unemployment Tax
4001 :
4010 PRINT #G,X$:TAB(Z1);"208";
4012 LET Z = L3 :: SUTA
4014 RJUST= 5
4016 DIGITS= 2:PRINT #G,TAB(Z2);"% ";Z::DIGITS=0
4018 :
4020 : Deposits due?
4022 :
4030 IF V1 < 0 THEN PRINT #G,TAB(Z3);M$(6):GOTO 4088
4032 PRINT #G,TAB(Z3);
4034 PRINT #G,M$(1);"-";M$(7);" ";M$(4);" ";M$:TAB(Z4);F$(5)
4038 PRINT #G,TAB(Z3);
4040 PRINT #G,M$(1);"-";M$(7);" ";M$(4);" ";M$:TAB(Z4);F$(6)
4088 RJUST= 0
4090 RETURN
4098 :
5000 : : North Carolina Income Tax
5001 :
5010 PRINT #G,X$:TAB(Z1);"207";
5012 LET Z = L2 :: Tax amount
5014 RJUST= 5
5016 DIGITS= 2:PRINT #G,TAB(Z2);"% ";Z::DIGITS=0
5018 :
5020 : Taxes due?
5022 :
5024 : Report every month
5026 :
5030 PRINT #G,TAB(Z3);M$(1);"-";M$(7);" ";M$(2);" ";M$:TAB(Z4);F$(8)
5040 IF M = 1 PRINT #G,TAB(Z3);M$(7);" ";M$(4);" ";M$:TAB(Z4);F$(7)
5088 RJUST= 0
5090 RETURN
5098 :
8000 : : Binary search of CHART.DAT
8001 :
8010 LET L = 1:U = RSIZE #10
8020 LET R = INT((L + U)/2):: Select the middle record
8030 RECNO #10 = R
8032 GOSUB 9200:: Get Record R
8040 IF N = A THEN 8090:: We found it!
8050 IF N < A THEN U = R - 1: GOTO 8020::Decrement upper limit
8060 LET L = R + 1:: Increment lower limit
8070 GOTO 8020:: Keep searching

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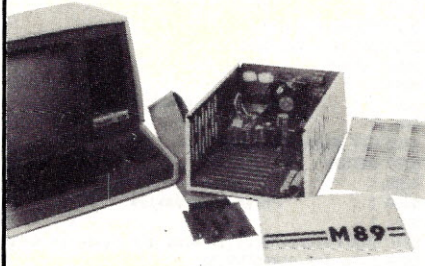
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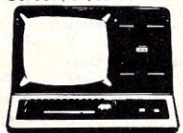
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Listing continued.

```

8090 RETURN
8099 :
8100 :      Which port for output?
8101 :
8110 PRINT
8117 :
8118 : These values are for printer at 16.5 character per inch
8119 :
8120 LET Z1=22:Z2=35:Z3=58:Z4=115
8122 :
8130 INPUT "Which port for output ",Q
8140 IF Q <> 3 THEN Q = 1:: Force output to terminal
8147 :
8148 : Next line sets DEC LA-34 printer to 16.5 cpi
8149 :
8150 IF Q = 3 THEN PRINT #Q,ESC(91);CHR$(52);CHR$(119);
8190 RETURN
8199 :
8200 :      Report Header
8201 :
8210 PRINT #Q
8212 LET L$ = " ":GOSUB 8900:: Underline
8218 PRINT #Q,TAB(Z3-LEN(P$)/2);P$:PRINT #Q
8220 PRINT #Q,TAB(Z3-LEN(N$)/2);N$:PRINT #Q
8230 PRINT #Q,"AS OF: ";D$:: Today's date
8240 LET L$ = " ":GOSUB 8900
8250 PRINT #Q,"Tax";TAB(Z1);"Account";TAB(Z2);"Amount of";TAB(Z4);"Use"
8260 PRINT #Q,"Burden";TAB(Z1);"Number";TAB(Z2);"Liability";TAB(Z3);"Comments";TAB(Z4);"Form"
8270 LET L$ = " ":GOSUB 8900
8290 RETURN
8299 :
8900 :      Under line with L$
8901 :
8910 FOR X = 1 TO Z3 + 3
8920 PRINT #Q,L$;
8930 NEXT X
8980 PRINT #Q
8990 RETURN
8999 :
9000 :      Get a record from #19 - Parameter File
9001 :
9010 RECNO #19 = V
9020 GET #19,A,B,A$
9090 RETURN
9099 :
9200 :      Get #10 - CHART.DAT
9201 :
9210 GET #10,A,A$,B,C,D
9290 RETURN
9299 :
9800 :      Program Variables
9801 :
9810 DIM F$(99),M$(97)::Forms and messages data arrays
9830 OPEN #19,0:MASTER.DAT
9832 LET V = 2:GOSUB 9000:M = A:R$ = STR$(M)::See text
9834 LET M$=STR$(M):M$=MID$(M$,5,2):M=VAL(M$)::The number of this month
9836 LET V = M:GOSUB 9000:C$ = A$::Name of this month
9840 LET V1 = IMOD(M,3)::Flas for end of quarter
9842 IF M = 12 THEN V = 1:GOTO 9846
9844 LET V = M + 1::This is next month
9846 GOSUB 9000:M$ = A$::The name of next month
9848 DLM=OFF
9850 LET V = 13:GOSUB 9000:N$ = A$::Company name
9852 LET V = 14:GOSUB 9000:D$ = A$::Today's date- readable
9854 DLM=ON : CLOSE #19::Don't need file any longer (or shorter)!
9856 FOR X = 1 TO 9:READ F$(X):NEXT X:: Fill the Forms Array
9858 FOR X = 1 TO 7:READ M$(X):NEXT X:: Fill the Message array
9872 LET R$ = RIGHT$(R$,2)
9874 LET P = VAL(R$)::Today's day
9876 IF P <= 7 THEN R$ = "after the 7th"
9878 IF P >= 8 IF P <= 15 THEN R$ = "after the 15th"
9880 IF P >= 16 IF P <= 22 THEN R$ = "after the 22nd"
9882 IF P >= 23 THEN R$ = "after the end of month"
9884 LINE= 0::Unlock line length feature of BASIC
9886 LET P$ = "Payroll Liability Status Report"
9888 OPEN #10,0:CHART.DAT
9890 RETURN
9899 :
9900 :      Data
9901 :
9910 :      FORMS
9911 :
9920 DATA 940,941,501,508
9922 DATA NCU1-101,NCUI-625,NC-3,NC-5,W-2's
9929 :
9930 :      Message data statements
9931 :
9932 DATA Deposit due
9933 DATA on the 15th of
9934 DATA within 3 banking days
9936 DATA last day of
9938 DATA Quarterly Report - last day of
9940 DATA No deposits due
9942 DATA Report due

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NAME

DESCRIPTION

1 RULE78	Interest Apportionment by Rule of the 78's
2 ANNU1	Annuity computation program
3 DATE	Time between dates
4 DAYYEAR	Day of year a particular date falls on
5 LEASEINT	Interest rate on lease
6 BREAKVEN	Breakeven analysis
7 DEPRSL	Straightline depreciation
8 DEPRSY	Sum of the digits depreciation
9 DEPRDB	Declining balance depreciation
10 DEPRDDB	Double declining balance depreciation
11 TAXDEP	Cash flow vs. depreciation tables
12 CHECK2	Prints NEBS checks along with daily register
13 CHECKBK1	Checkbook maintenance program
14 MORTGAGE/A	Mortgage amortization table
15 MULTMON	Computes time needed for money to double, triple, etc.
16 SALVAGE	Determines salvage value of an investment
17 RRVARIN	Rate of return on investment with variable inflows
18 RRCONST	Rate of return on investment with constant inflows
19 EFFECT	Effective interest rate of a loan
20 FVAL	Future value of an investment (compound interest)
21 PVAL	Present value of a future amount
22 LOANPAY	Amount of payment on a loan
23 REGWITH	Equal withdrawals from investment to leave 0 over
24 SIMPDISK	Simple discount analysis
25 DATEVAL	Equivalent & nonequivalent dated values for oblig.
26 ANNDEF	Present value of deferred annuities
27 MARKUP	% Markup analysis for items
28 SINKFUND	Sinking fund amortization program
29 BONDVAL	Value of a bond
30 DEplete	Depletion analysis
31 BLACKSH	Black Scholes options analysis
32 STOCVAL1	Expected return on stock via discounts dividends
33 WARVAL	Value of a warrant
34 BONDVAL2	Value of a bond
35 EPSEST	Estimate of future earnings per share for company
36 BETAALPH	Computes alpha and beta variables for stock
37 SHARPE1	Portfolio selection model i.e. what stocks to hold
38 OPTWRITE	Option writing computations
39 RTVAL	Value of a right
40 EXPVAL	Expected value analysis
41 BAYES	Bayesian decisions
42 VALPRINF	Value of perfect information
43 VALADINF	Value of additional information
44 UTILITY	Derives utility function
45 SIMPLEX	Linear programming solution by simplex method
46 TRANS	Transportation method for linear programming
47 EOQ	Economic order quantity inventory model
48 QUEUE1	Single server queueing (waiting line) model
49 CVP	Cost-volume-profit analysis
50 CONDPFOT	Conditional profit tables
51 OPTLOSS	Opportunity loss tables
52 FQJQOQ	Fixed quantity economic order quantity model
53 FQEOQSH	As above but with shortages permitted
54 FQEOQPB	As above but with quantity price breaks
55 QUEUECB	Cost-benefit waiting line analysis
56 NCFANAL	Net cash-flow analysis for simple investment
57 PROFIND	Profitability index of a project
58 CAP1	Cap. Asset Pr. Model analysis of project

59 WACC	Weighted average cost of capital
60 COMPBAL	True rate on loan with compensating bal. required
61 DISCBAL	True rate on discounted loan
62 MERGANAL	Merger analysis computations
63 FINRAT	Financial ratios for a firm
64 NPV	Net present value of project
65 PRINDLAS	Laspeyres price index
66 PRINDPA	Paasche price index
67 SEASIND	Constructs seasonal quantity indices for company
68 TIMETR	Time series analysis linear trend
69 TIMEMOV	Time series analysis moving average trend
70 FUPRINF	Future price estimation with inflation
71 MAILPAC	Mailing list system
72 LETWRT	Letter writing system-links with MAILPAC
73 SORT3	Sorts list of names
74 LABEL1	Shipping label maker
75 LABEL2	Name label maker
76 BUSBUD	DOPE business bookkeeping system
77 TIMECLK	Computes weeks total hours from timeclock info.
78 ACCTPAY	In memory accounts payable system-storage permitted
79 INVOICE	Generate invoice on screen and print on printer
80 INVENT2	In memory inventory control system
81 TELDIR	Computerized telephone directory
82 TIMUSAN	Time use analysis
83 ASSIGN	Use of assignment algorithm for optimal job assign.
84 ACCTREC	In memory accounts receivable system-storage ok
85 TERMSPAY	Compares 3 methods of repayment of loans
86 PAYNET	Computes gross pay required for given net
87 SELLPR	Computes selling price for given after tax amount
88 ARBCOMP	Arbitrage computations
89 DEPRSF	Sinking fund depreciation
90 UPSZONE	Finds UPS zones from zip code
91 ENVELOPE	Types envelope including return address
92 AUTOEXP	Automobile expense analysis
93 INSFILE	Insurance policy file
94 PAYROLL2	In memory payroll system
95 DILANAL	Dilution analysis
96 LOANAFD	Loan amount a borrower can afford
97 RENTPRCH	Purchase price for rental property
98 SALELEAS	Sale-leaseback analysis
99 RRCONVBD	Investor's rate of return on convertible bond
100 PORTVAL9	Stock market portfolio storage-valuation program

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By Frank J. Derfler

I don't care how many wires or what kind of matrix it has, this funny kind of print just isn't good enough for my newsletter."

With that none-too-subtle evaluation, my wife steamed out of the

room. The words had a particular bite because one of my justifications for spending \$700 on a dot matrix printer was that it would be used to print the charity newsletter my wife edits. I had even deducted an ap-

propriate percentage of the cost from my taxes as a contribution to charity.

Unfortunately, some of my wife's readers had complained that the print was funny looking and made their eyes water. Tears were welling up in my eyes too as I imagined myself sitting across from the IRS auditor trying to explain a \$500 charity deduction while my noble wife expounded on the evils of dot matrix print. They had just snapped on the handcuffs and were leading me away when the doorbell rang and woke me up from my gloomy daydream.

Standing at the door, with his cowboy hat pushed back on his head and a wide grin on his face, stood my friend and neighbor, Vic Interrupt. There was a large box in back of him.

"Morning," he said.

"What's that?" I asked, trying to see around his rather large frame wrapped in a plaid cotton shirt.

"I just bought me a new printer," Vic said. "Got an \$800 tax refund check and went out and spent it."

"Oh no, Vic!" I replied. "Those \$800 printers are all alike. They're all dot matrix. They print pretty fast, but their print looks funny. I just decided



The Smith-Corona TP-I is a U.S. made, daisywheel, letter-quality printer with a retail price under \$900. It is advertised at under \$800 by some outlets. It operates about twice as fast as a professional typist and produces documents any business person or professional would be happy to send.

Address correspondence to Frank J. Derfler, PO Box 691, Herndon, VA 22070.

I'm going to have to spend at least twice that much so I can get one of those new Japanese daisywheel printers. Dot matrix just isn't good enough."

Vic looked hurt. Then he grinned again and wrestled the box through the door. "Not so, little buddy," he said. "This here is a genuine made-in-America printer that is going to answer your dreams. It's a TP-I made by Smith-Corona."

The IRS auditor in my daydream suddenly stopped smiling and started chewing on his pencil.

Vic flicked open his folding Buck knife with one hand and proceeded to carve the printer out of its double-boxed triple-insulated cocoon.

I cleared some space on the table next to the IBM PC and he set the Smith-Corona down. It took up less space than my dot matrix printer, and the color was nearly identical to the IBM Personal Computer.

I lifted the lid and exclaimed, "It's a daisywheel!"

"Yup, prints pretty, too," Vic replied.

"Eight hundred dollars?" I asked.

"Well, eight and a half, maybe," Vic replied. "List is \$895."

"Made in the United States?"

"Guy at the store said he had been to the factory in Cortland, NY."

"Let's make it work," I said, grabbing the plug. "Oh, is it serial or parallel?"

"It comes in either model. This one is parallel."

I pulled the cable off the back of the dot matrix printer (I never fasten those funny little clips) and plugged it into the TP-I. Then I grabbed the three-prong ac plug and put it into the wall. "How do you turn it on?" I asked.

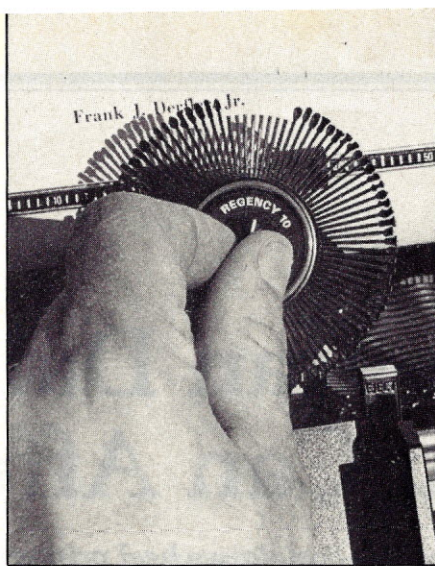
"Gotta be a switch," Vic observed sagely.

We looked all around the front and sides of the machine, but didn't find a power switch. Vic hopefully toggled the front panel switch labeled "TOP OF FORM," but still the machine did not stir.

"You don't think we should read the book, do you?" I asked after another futile search.

"Naw, that's un-American," Vic replied as he lifted the printer in his two paws and held it upside down. "The switch is on the back by the power cord."

Vic put the printer down, cleared away some shipping restraints from the print wheel, groped for the



The TP-I print wheel is easy to change. Six type-wheels are available for 10-pitch machines and five for the 12-pitch. Standard type fonts include pica, elite and script.

switch, and turned it on.

The printer beeped. The print mechanism immediately danced to the left, spaced to the right, tabbed to the right margin, and spaced to the left.

"It's dancing," Vic observed.

"At least you know it's working when it comes on," I said. "That's quite an initialization routine."

"What's that noise?" Vic asked.

The sound of the print mechanism

had covered another noise that was slowly growing to a low howl.

"It has a fan," I said, "but it sure isn't a whisper fan." The noise of the fan was really quite loud. It was louder than the fan in the IBM PC (which is not quiet) and louder than the motors in the eight-inch drives in the TRS-80 Model II.

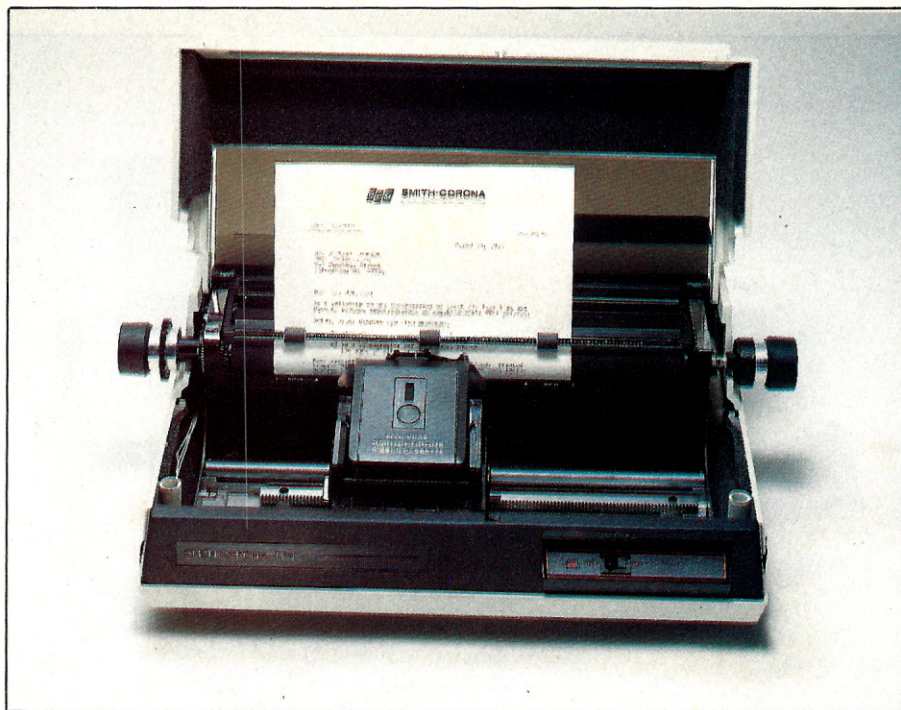
"I didn't notice it in the store," Vic said. The noise of the fan probably would not be noticed in a store or office with a normal level of background noise. In a quiet home computer room, however, it was both loud and piercing.

I loaded a word processing program into the PC and selected a text file for printing. Vic rolled a piece of paper into the TP-I.

"Works just like a typewriter," he observed. "They are coming out with a tractor feed soon, but it isn't ready yet. This friction feed is easy to load and the paper goes in real square, too."

"Smith-Corona has been in the typewriter business a long time," I said. "I had an old Smith-Corona manual typewriter I used in college—and that was a long time ago."

"All we had was some chalk and a slate," Vic said. I laughed because I knew Vic was a touch typist. He always started typing by sitting up straight with his feet flat under his



Three different ribbons are available for the TP-I. A single-strike film ribbon gives excellent quality and lasts for about 57,000 characters. A multistrike film ribbon gives good quality and lasts for 250,000 characters. A fabric ribbon is also available with about the same life. The ribbons are standard in the Smith-Corona line and are available at typewriter and office supply stores around the world. Parts and service are available from authorized Smith-Corona service stations.

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chair and his fingers in the "home" position. Somebody at Georgia Tech had taught him more about typing than he liked to admit. I hit the return key on the PC as the final command telling the program to print.

The TP-I came to life with no fanfare and began to print. I thought that it sounded like an office typewriter being run by a very efficient secretary.

"It's not very fast," Vic said.

"That's all relative," I said. "Let's see what the specs are." Vic would accept reading the manual after the machine was up and running. "It says the print speed is 12 cps, which translates to about 140 words per minute. That's more than twice as fast as any professional secretary I know, and look at the quality! It's as good as any typewriter on the market. By the way," I asked, reading on, "did you get a 10-pitch or 12-pitch machine?"

"I don't know," Vic replied. "Is there a difference?"

"Yes, it says they are two different machines. When you buy a TP-I you have to decide if you want a serial or parallel port and if you want a 10- or 12-pitch machine. The 10-pitch can get 105 characters on a line, and the 12-pitch can print 126 characters on a line."

"Will it underline or anything?" Vic asked.

"Well, it won't proportional space, but let's see what it says about underlining." The Smith-Corona instruction manual that comes with the TP-I has 36 pages and a good table of contents. It is written in a friendly style and uses bold print with many illustrations.

"Yes, it says the underlining feature is turned on when the machine receives an ASCII 'EM' character, which it says here is a hex 19. It continues to underline until it receives another hex 19. The tabs and margins can be set by software commands too. You can change the tabs and margins dynamically as you print by sending the ASCII codes down the line."

"How would you do that?"

"Well, it might be difficult with some word processing programs. Some packages don't have any provision for embedding the nonprinting ASCII codes, but other packages do. In WordStar, for instance, you would use the control P series of commands. In Apple Pie, you ought to be able to use the control A commands."

"Another sure way to do it is to write your text as a Basic program us-

ing print statements. You could include CHR\$ statements that send out the right hex code in the Basic program. You could print out stuff with all sorts of fancy margins, columns and underlines."

Vic was only half listening. He was peering inside the printer and I could tell he couldn't wait to take the top off. Vic doesn't care much for software, but he loves the hardware. He used an allen wrench and a phillips screw driver and had the cabinet off almost before I had a chance to pull the plug. The howl of the fan died away and left the room comparatively quiet.

"Hmmm..." Vic said. "Not too many moving parts. Sure is easy to get the ribbon and print wheel in and out. They use an optical sensor to position the print mechanism. Good quality circuit boards. Looks like a custom IC to do the logic. Nice power supply with a good size transformer."

"I see what the fan is for. They have it blowing over the power supply and over these big resistors. Those resistors have gotta be connected with the motor."

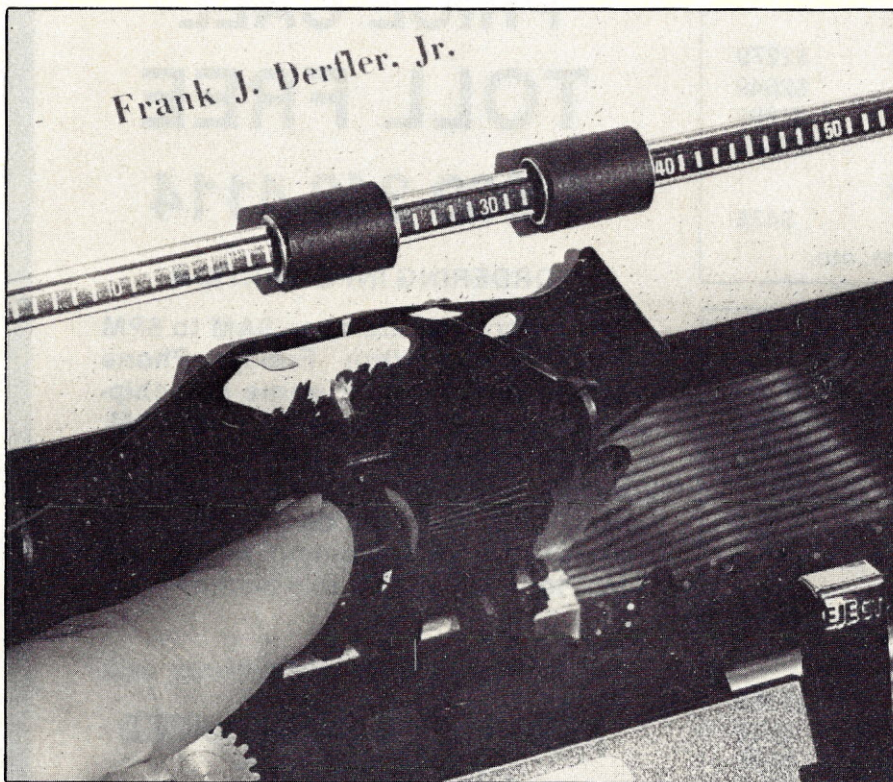
"Do you think they really need that fan, or is it conservative engineering?" I asked.

"I'm sure they were being conservative. I'll bet you could run the thing for hours without the fan and not have it heat up. It all depends on how much you run the motor. When it's just sitting you sure don't need the fan."

"Could we put in a second switch and cut it out when it isn't needed?" I asked.

"Bad engineering," Vic scowled. "Liable to forget it. A radio ham I know had one trick for a loud fan. Used to put a heavy diode in series with the motor. Made it run slower, but a whole lot quieter. Best thing, besides putting in a quieter fan, would be a little thermostat. Sure to void your warranty if you do it though."

Vic prowled around the printer's insides and tried to identify the function of each part. He was pleased with the installation of the parallel interface board. I read him pieces out of the manual including the fact that the RS-232C serial version came with a 32-byte buffer. We both agreed that we would have traded the power-on light on the front panel and one of the platen knobs for a couple of K of print buffer; the redundant platen knob made the machine take up an inch



The print mechanism operates only when moving from left to right. The hammer strikes the print wheel to make fully formed characters on the paper. A manual control sets the force of the hammer and lets you make up to five carbon copies. Other manual controls set the line spacing and provide for easy paper positioning.

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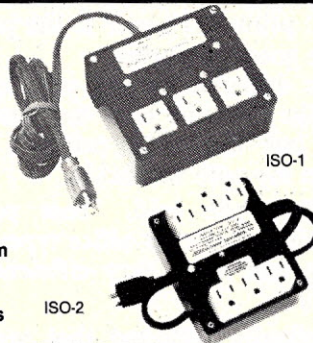
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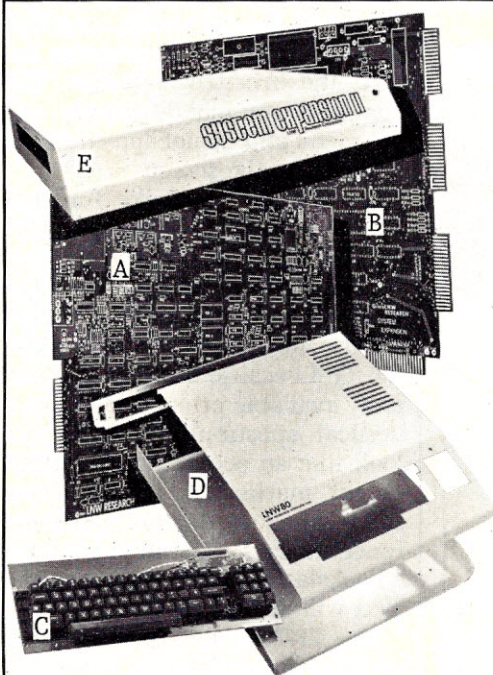
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more space, and you can hear it when it's on. And operating with an RS-232C printer is easier if the printer has a good size buffer.

Vic declared himself pleased and put the machine back together. We had just started it printing again when my wife walked in.

"Oh," she said, "that printer sounds just like an office typewriter being run by a very efficient secretary!"

I silently reflected that we had been married too long—we were thinking too much alike. Aloud I said, "Look at the print quality. It's excellent. I can't wait to tell the Feds."

For a moment, I thought I was about to die. Vic was staring at me in a strange way. He was holding his breath and flexing his arms. Vic's only contact with the Feds was through representatives of the Department of the Treasury. They took a deep interest in his synthetic fuel production plant. The plant was located in his garage and it included a copper coil which slowly dripped a clear liquid into Mason jars. Vic called his "fuel" Old Megabyte, and it had provided the inspiration for more than one of our research projects.

The idea of one of his neighbors "telling" something to the Feds meant only one thing to Vic: They were turning him in. I started to explain, but the story about IRS day-

dreams took on a very hollow sound. I began to stammer more as his face turned a deeper and darker red.

Vic stormed out of the house, leaving my head intact; he left the TP-I behind. I decided to let him cool down before trying to explain again.

That was four weeks ago. My wife has gotten out two issues of her newsletter on the TP-I and they look great. I am growing a beard and may try to sneak out of the house some night next week. Meanwhile, I hope the IRS gets to me before Vic does. ■

WordStar and the TP-I

Since the WordStar word processing program from MicroPro is so popular, you might be interested in how the Smith-Corona TP-I interfaces with WordStar. I used the WordStar INSTALL.COM program and selected "Teletype-like Printer That Can Backspace" from the menu. The TP-I understands the WordStar commands and performs those within its capabilities beautifully. The special commands it can perform include underlining, boldface/double strike, strikeout and overprinting. The TP-I doesn't provide subscript or superscript printing.

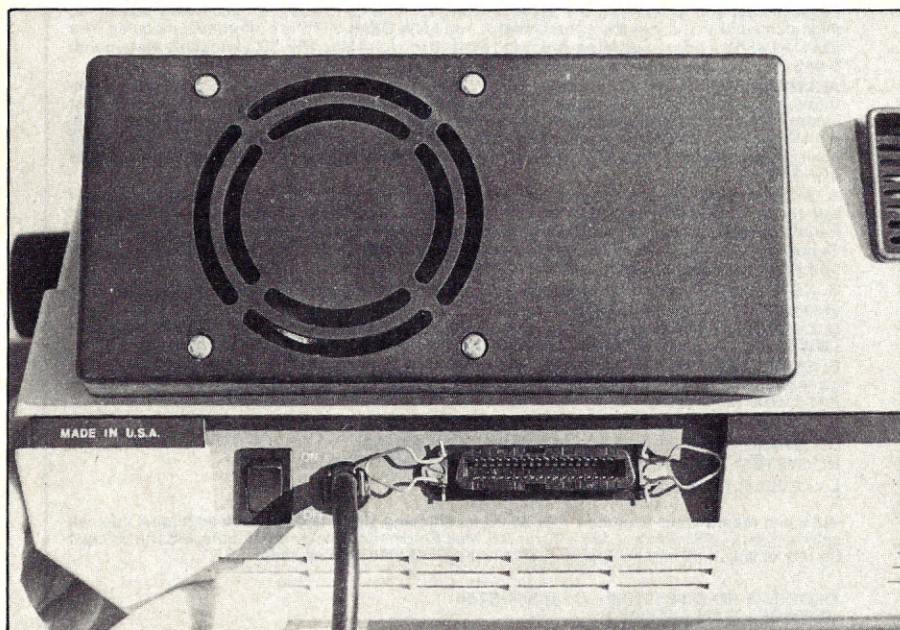
Underlining is done using the control-P control-S sequence to begin the underline and the identical sequence to turn it off. The TP-I/WordStar combination underlines only the characters, skipping the spaces.

The double strike and bold print features of WordStar also work with the TP-I, but the character positioning of the printer is so good that it's hard to tell when a double strike has taken place. This feature could be useful when making multiple carbons, but the printer also has a separate manual impression control to increase the force of the hammer strikes. The multi-strike bold print feature does make a visible difference in the darkness of characters even though the TP-I does not have the microspace feature most printers use for bold print.

The strikeout feature of WordStar works with the TP-I to allow line-in line-out format in legal and administrative documents. In this format, corrections are shown by overstriking the old words with dashes. WordStar makes the overstrike simple, using control-P, control-X, the old words, control-P and control-X. The program inserts the overstruck dashes. The control-P commands simply call the menu and do not appear in the text line on the screen.

A separate overstrike function exists in WordStar, which the TP-I will also respond to. The overstrike function is normally used to place accent marks on foreign words. This function is limited on the TP-I because most of the presently available printwheels have a vertical apostrophe that doesn't look like an accent and no other accent marks. But if you have some other use for an overstrike function (such as striking out with a backslash instead of a dash), the TP-I will do it.

The TP-I is a low-priced printer with useful capabilities. When it is combined with a powerful word processing program such as WordStar, certain special functions become simple to use. ■



A rear view of a TP-I equipped with a parallel port. Note the "Made in U.S.A." label. There is also a label certifying that the printer has met the FCC Part 15 rules pertaining to radio frequency emission. The two parts of the TP-I that could use better "human engineering" are also shown in this picture—the fan creates too much high-pitched noise for pleasant operation in a quiet setting, and the power switch requires a little fumbling to find.

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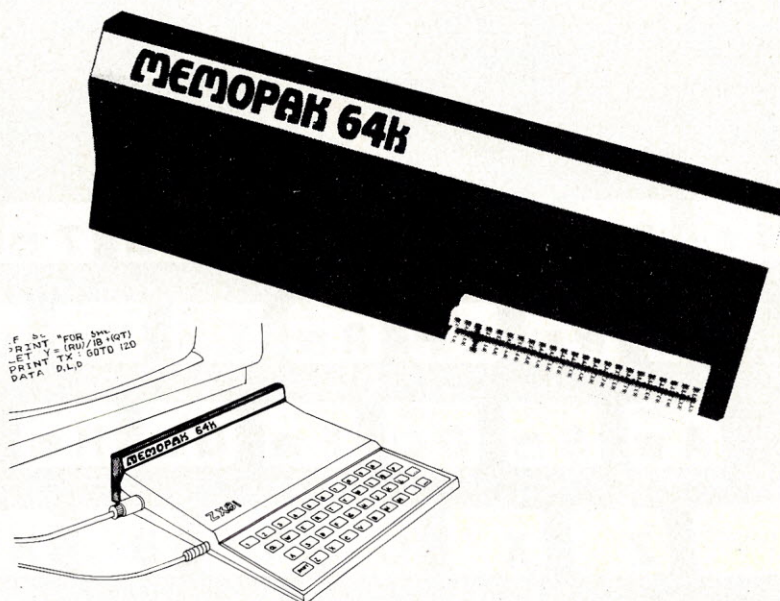
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The ZX81 is also very convenient to use. It hooks up to any television set to produce a clear 32-column by 24-line display. It comes with a comprehensive programming guide and operating manual designed for both beginners and experienced computer users. And you can use a regular cassette recorder to store and recall programs by name.

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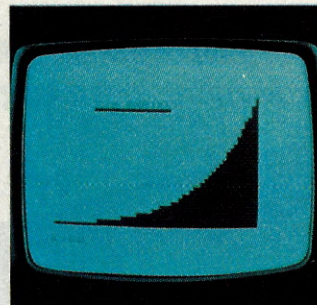
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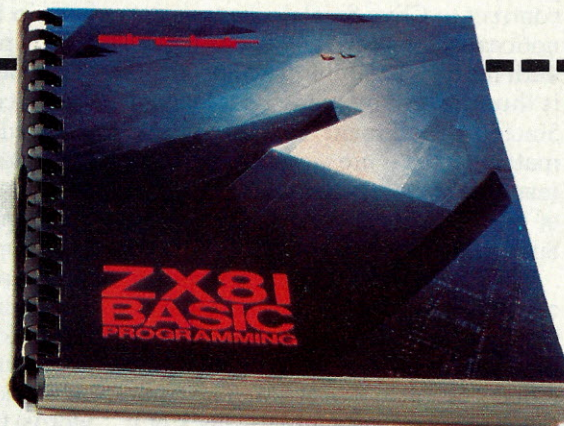
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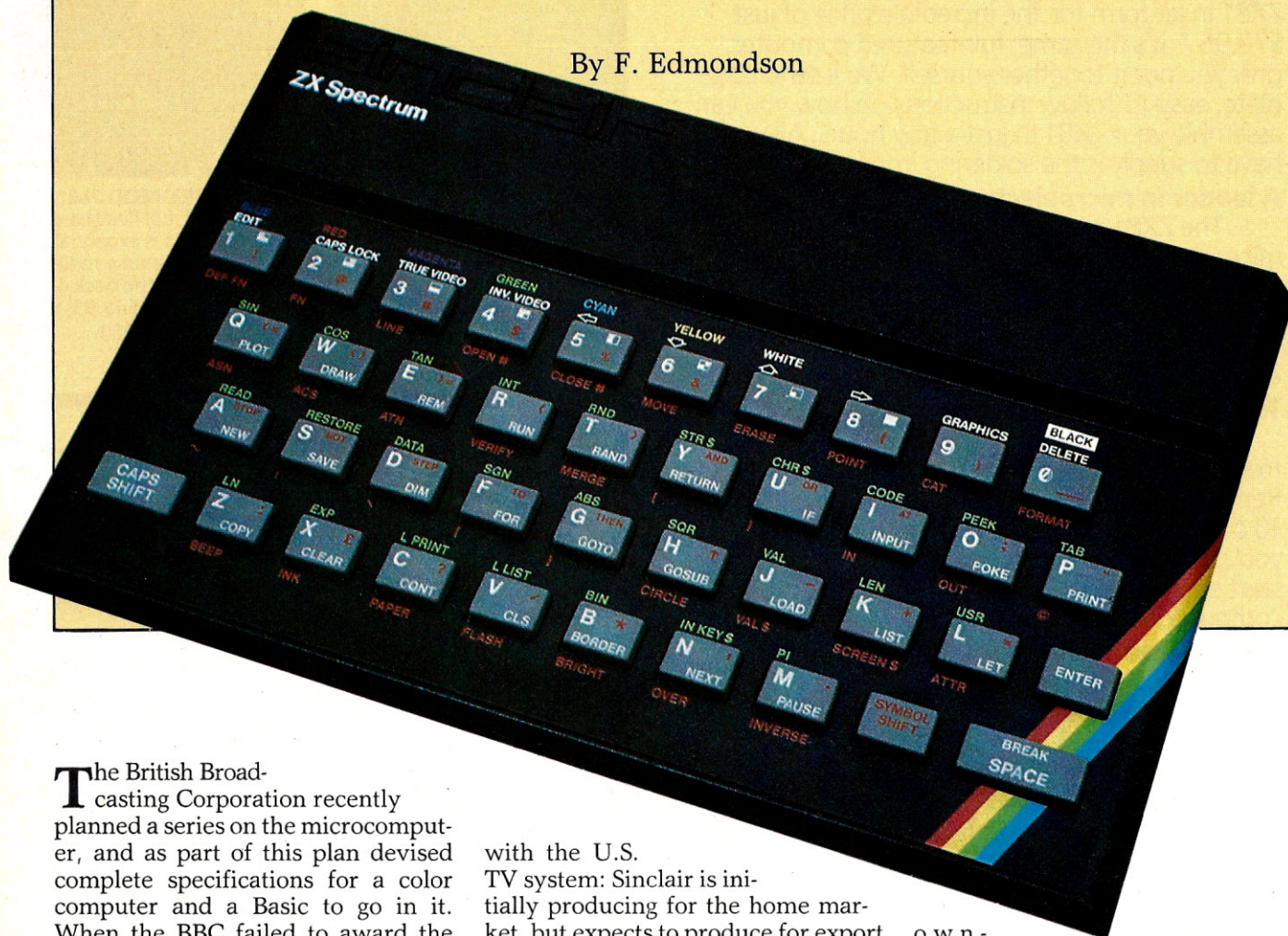
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Sinclair Does It Again!

Sinclair will soon be invading the U.S. with a low-cost (what else?) color computer featuring improved graphics and a truly "expanded" Basic.

By F. Edmondson



The British Broadcasting Corporation recently planned a series on the microcomputer, and as part of this plan devised complete specifications for a color computer and a Basic to go in it. When the BBC failed to award the contract to Clive Sinclair, he was not noticeably pleased, and went ahead with his own machine. The Spectrum is thus thought by many people to be Sinclair's comment on the whole matter. It is quite a comment. His machine costs less than half the price of the BBC micro, and, according to Sinclair, is more powerful.

The Spectrum color computer comes with a 16K Basic and Operating System ROM (twice the size of that fitted to the ZX81) and with either 16K or 48K of RAM. The computer plugs directly into the back of a standard British PAL color or black and white television set. A modified model will be needed for operation

with the U.S.

TV system: Sinclair is initially producing for the home market, but expects to produce for export later in the year.

The price of the basic 16K RAM machine is set at £125, while the 48K model costs £175. The basic machine is readily upgraded to 48K by a £60 on-board addition. Judging by the current stateside prices of the ZX81, I'd estimate the U.S. price of the 16K Spectrum will be in the region of \$270, and the 48K machine, \$375. (A conversion rate of \$2.14 to the £ seems to be about right.) This is a fantastic value for the money, and is achieved by "elegant design" (Clive's words) that limits the IC count to 14—which includes eight memory chips.

There are also substantial improvements to the keyboard, which ZX81

owners such as myself will welcome. The Spectrum has 40 moving keys, similar to those used on the Sinclair Oxford calculator. These keys are made of a non-slip rubber to which one readily becomes accustomed. As with the ZX81, each key performs several functions, and is marked accordingly. Only the small red set of markings on the key-tops was found to be too small and difficult to read.

There is an auto-repeat on all keys with full upper- and lowercase and a

Address correspondence to F. Edmondson, 59 Grange Road, Dorridge, Solihull, West Midlands, B93 8QS England.

shift lock. The new keyboard is about 30 percent bigger than the old, bringing the key spacing to around 90 percent of a full-size keyboard. Touch-typing is possible for alphanumeric characters. A simple Poke to a location in RAM will add a beep to any keystroke, as confirmation that a key has been pressed. I found this useful before I learned the "feel" of the keys.

The screen shows 24 lines of 32 characters; the bottom two lines are for editing and checking. Sinclair states that user software can generate 40 characters per line to make the machine videotext-compatible. Text and graphics can be displayed at the same time.

Graphics

The graphics are high-resolution—256 dots horizontally and 175 vertically—and are each individually addressable. These are memory-mapped in the RAM, one byte of RAM being dedicated to each 8×8 pixel character square. Just over 8K bytes of RAM remain after meeting the needs of the display and general housekeeping.

Eight foreground and eight background colors, normal and extra brightness with flashing or steady mode, are available. Unfortunately the bandwidth limitation of PAL color encoding is the overall limiting factor of the system, and so the display does not do justice to the machine's software. You can see this when you compare horizontal and vertical lines. An RGB output to a monitor would be a great help in fully using the superb color graphics display.

Sinclair has provided an unusual facility for defining new characters. Twenty-one such characters may be created and used quite simply by entering Graphics mode and typing the relevant letter key (A to U). The new characters consist of 8×8 squares of pixels typed in as eight eight-digit binary numbers. You could write a short program to simplify the actual poking of the digits into memory location.

Graphics are limited by memory considerations, and form an internal rectangle on about 70 percent of the screen. Clear and adequate instructions in the manual let you draw straight lines and circles with simple commands. Five short statements will produce a pair of sets of cotangential circles. These are

CLS:FORA=1TO80STEP 2:CIRCLEA,86,

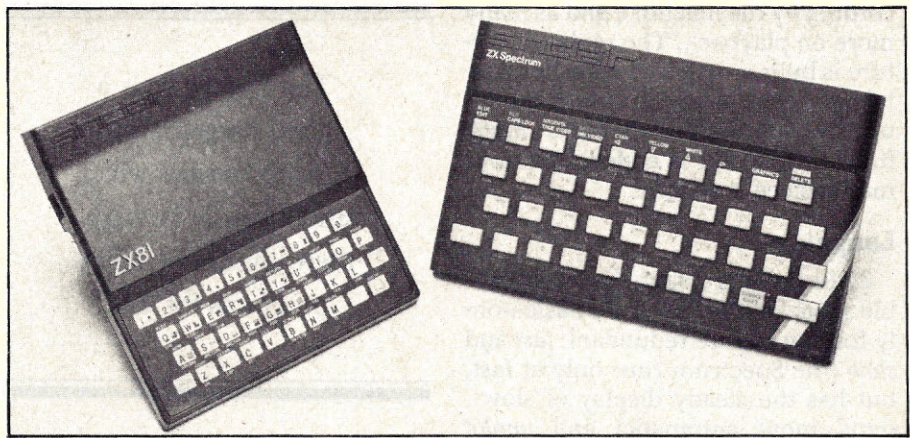


Photo 1. The Spectrum keyboard is close to standard typewriter size. The moveable keys give a more satisfying "feel" than the ZX81's membrane surface.

A:CIRCLE255-A,86,A:NEXTA

The speed and regularity with which the nests of circles are produced is most impressive.

Colors are equally simple to produce. Background is defined as "paper" while the characters are referred to as "ink." The colors themselves range from 0 (black) to 7 (white) and are labelled as such on the numerical keys. Two values of brightness are available.

Text can be printed using the existing ZX printer, which interfaces directly with the Spectrum. Power is derived from the computer; the tiny printer plugs into the back of the computer with a socket for further attachments. The copy command results in the transfer of the complete screen contents directly to paper. The electrostatic paper is just four inches wide and copies well.

The circles for which the program has been given printed out as clearly as they showed on the screen, and text is perfectly legible despite the small size.

Whereas Sinclair has recently reduced the U.K. price of the 16K RAM kit for the ZX81 from just under £50 to £30, the price of the printer has been increased from just under £50 to just under £60. Sinclair intends shortly to offer a standard RS-232 interface which will permit the use of other types of printers.

Storage

Another item due for later release is the ZX Microdrive, which is a new, low price micro-floppy. Each can hold as much as 100K bytes on a single changeable disk. The data transfer rate is 16K bytes per second. Up to eight Microdrives can be connected to the Spectrum—and may

well be, for the projected cost per drive is only £50!

Average access time is said to be less than 3.5 seconds, which suggests that random access will not be used. However, the high speed of data transfer will make this a most attractive alternative to the conventional tape recorder. The keywords open, close, move, erase, catalogue and format are already in the ROM and are ready to be used when a disk is added.

This new interface and drive open up possibilities for the Spectrum in offices, schools and industry. Networks of ZX Spectrum machines can share common facilities, and be linked to larger machines and equipment.

The tape cassette port of the Spectrum has an improved interface. A tone leader is transmitted before the data in order to overcome the problems generated by the automatic recording controls of some tape recorders, and a Schmitt trigger helps remove noise on playback. Programs, screens, blocks of memory, string and character arrays can all be saved, and verified after saving. Programs and arrays can also be merged from tape, which is most useful when handling long programs.

The tape data transfer rate has been improved to 1500 baud. The change has the disadvantage of making it impossible to run ZX81 tapes directly into the Spectrum. No doubt this problem will shortly be overcome by one or other of the interested groups of enthusiasts.

Perhaps the most visually impressive of all the new facilities that the Spectrum provides is that of saving the contents of a color screen. The command `SAVE "Name" SCREEN$` results in quite a few seconds of re-

cording by the machine, and as many more on playback. The replayed picture is built up as three wide horizontal bars, each of which in turn is built up by successive alternate lines; finally, the color is added, and your masterpiece is reborn!

Language

ZX81 Basic is essentially a compatible subset of the Spectrum Basic—only four words are redundant: *fast* and *slow* (the Spectrum runs only at fast, but has the steady display of slow), *scroll* (now automatic) and *unplot* (plotover is now used). You should thus have little difficulty in transferring programs from the ZX81 to the new machine.

Too often when examining "expanded" Basics, I find that the new facilities are by no means as powerful as the increase in size would lead me to expect. The Spectrum Basic is an exception: multistatement lines have been introduced (ink, paper, bright, flash, over and inverse control foreground and background colors); a full data mechanism has been provided; user-definable functions (DEF FN) have been established; multidimen-

The Spectrum is a good bargain, and since its sales will undoubtedly be high, there should be many programs for sale.

sional arrays are now permitted; and strings can be concatenated or sliced.

The computer prints eight decimal digits, but holds numbers to nine and a half digits in memory. This is much better than in many more expensive machines. ASCII code is now used for the alphanumerics, which will be a great help to machine code enthusiasts.

Docs

The Spectrum comes completely assembled, with power supply and manuals. There is a short book for newcomers to computing, and a de-

tailed manual for second reading. This latter volume is well written: it contains clear explanations illustrated by simple programs. The index is comprehensive, and contains a built-in guide to the keywords—handy for people who discover this before struggling to learn the layout of the keyboard.

Programs on music, random lines and movement are interesting, and form the basis of further efforts. The example on movement (a seconds clock) demonstrates in a simple way how the command Draw Over 1;x,y draws a line to a coordinate x,y, and a repetition of the identical command removes the line. This is very helpful with games and cartoons. Color and graphic codes can be inserted into text as desired.

Sound

The Spectrum contains a small speaker. Its quality is not particularly good, but its utility is high. You can use it to make "music." The command is BEEP a,b, where *a* is the duration of the note in seconds and *b* the pitch. Middle C is 0, 12 is the first octave, etc. Pitch can be expressed as an integer, a negative number or a decimal. Ten octaves are covered.

Output via the jack sockets is provided so you can amplify the signals or use a separate speaker. The choice of 12 intervals per octave corresponds to the number of notes, sharps and flats per octave and helps the musically talented programmer in transcribing from music sheet to machine.

Conclusion

The ZX Spectrum is as great an advance over the ZX81 as the ZX80 was over its competitors at the time of its introduction. It offers color, improved graphics and a well-planned ROM Basic, with the prospect of wide adaptability through the RS-232 interface.

The Spectrum is a good bargain, and since its sales will undoubtedly be high, there should soon be many programs for sale on cassette. Sinclair has recently made agreements with ICL and Psion software producers to extend their range of tapes. The Psion range, for example, includes Backgammon, a six-level chess and business programs entitled Vu-Calc and Vu-File. ZX81 payroll and tax programs—suitable for the U.K. tax laws—should soon be translated to the Spectrum machine. ■

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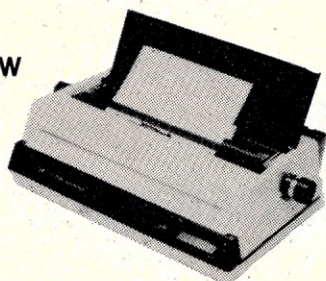
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Beat the High Cost Of H-88/89 Memory Expansion

When 48K is not enough, you can expand your H89 to 56K (65K with CP/M), for about \$100 less than with the Heath memory board. All you need are a little time and a few spare parts.

By Steve Howard

Have you bought the latest Dungeons and Dragons game for your H-89 only to get the "Out of RAM" error message while loading? Or have you received the same message while loading in the updated database for the new inventory you were working on all weekend?

The problem is that 48K bytes of memory is not quite enough for some of the larger programs, especially many of those written in Microsoft Basic. There is a way, however, to beat the high cost of memory expansion

in the H-88 or H-89. It will let you expand to 56K bytes (65K with CP/M) and save a lot of pocket change.

The first step is to obtain the ORG 0 address-decoder programmable read-only memory (PROM) chip from

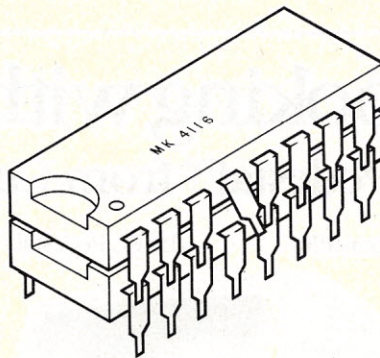


Fig. 1. Bend pin 4 of each of the new 4116 chips out slightly as shown. Place each new chip on an old one and solder corresponding pins together with the exception of pin 4.

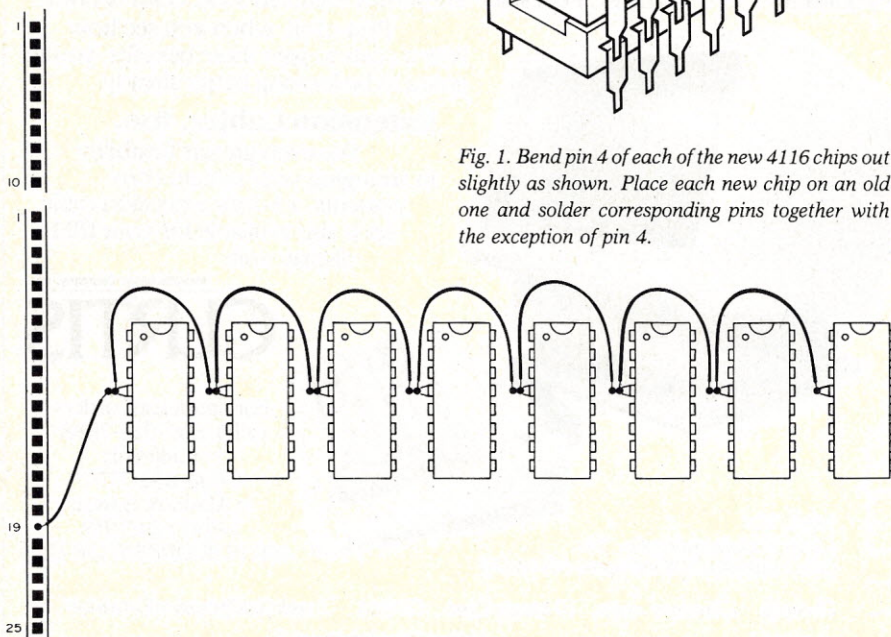


Fig. 2. Daisychain the select pins (4) of the new memory chips and connect to pin 19 of the left expansion bus (P509).

Heath. Check your CPU board at location U517 to see if you have the right one. The correct part number, which should be on the chip, is 444-66. A new PROM costs about \$12.

You'll also need eight 4116-4 (or faster) dynamic memory chips. These are available as expansion kit H88-2 from Heath, or from many mail-order companies.

Before you start, check out the existing chips in your computer.

You can do this by running any of the memory tests available from the Heath User's Group, or, more simply, by using the existing test in the H-89 ROM.

If you wish to run the memory test from the ROM, simply hit reset; when you get the H: prompt, type G, then 7375 and return. The memory test will immediately begin execution, after giving you the name of the test and the LWA (last working address-highest memory address) of

Parts List

QTY	HEATH PART NO.
1—Address Decoder	444-66
8—MK4116-4	443-904
(Available as H88-2 for \$39 when last checked.)	
1—74S132	approx. \$1.25
1—3-foot piece of 30 AWG wire-wrap wire	

Steve Howard (8895 72nd St. S., Cottage Grove, MN 55016) is president of the St. Paul-Minneapolis Heath User's Group.

your system. After running a few minutes, if no errors are detected, you're all set to begin.

Modification Steps

- Take one of the eight new memory chips and bend pin 4 out slightly; then place it on top of one of the unmodified chips from the H-88/89 (see Fig. 1).
- With the exception of pin 4, solder each pin of the top chip to the corresponding pin of the chip on the bottom. This places all pins except pin 4 in parallel. Pin 4 is the select line, which we will use later.
- Repeat steps 1 and 2 for seven more of the memory chips.
- Plug the piggy-backed chips back into the CPU board. (I used the top row of chips, but it makes no difference which row you choose.)
- Now you must daisychain the select pin of each new memory chip and connect this wire to pin 19 of the left expansion bus, P509 (see Fig. 2).
- To enable the ORG 0 function for

You can beat the high cost of memory expansion with this simple Heath modification.

CP/M, connect a wire from pin 17 of the left expansion bus (P509) to the middle pin on JJ503. Discard the jumper plug that was on JJ503; it's no longer needed.

- Place the jumper plug on JJ501 and JJ502 so that each is a 1. These are the leftmost two pins of the three. (Note: JJ501, JJ502 and JJ503 are all on the lower center section of the board between chips U517 and U554.)

- Replace the 74LS132 at location U562 with a 74S132. The 74LS132 may work initially, but I recommend you change it anyway. U562 is at the lower left corner of the board.

- Recheck all of the ICs to make sure they're plugged in properly.

- Power up the computer and run the memory test. Your LWA (last working address) should now be FFFF hexadecimal or 377377 split octal.

- Boot HDOS and it should now reply with SYSTEM HAS 56K RAM.

Several H-89/88 owners in my area have done this modification with no problems. ■

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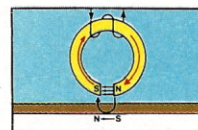
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A Super Synthesizer

Build the Speak 'N' Sing 2 speech synthesizer, which brings hi-fi speech and sound to computing.

By Richard R. Parry

Hello, police? I want to report a burglary at 211 South Ave. Please send police officers to investigate. Thank you."

When I developed my home security system (see "Computerized Security and Status System," *Kilobaud Microcomputing*, November 1980, p. 30), I knew that a desirable feature of the system would be an automatic call for help. It could save both life and property if someone was breaking into the house or a fire broke out.

The call for help should be one that everyone can understand. Alarms, sirens or flashing lights have heretofore been the traditional means for a

machine to communicate an emergency. However, such devices can't adequately describe the circumstances surrounding an event. Speech, on the other hand, can describe the situation.

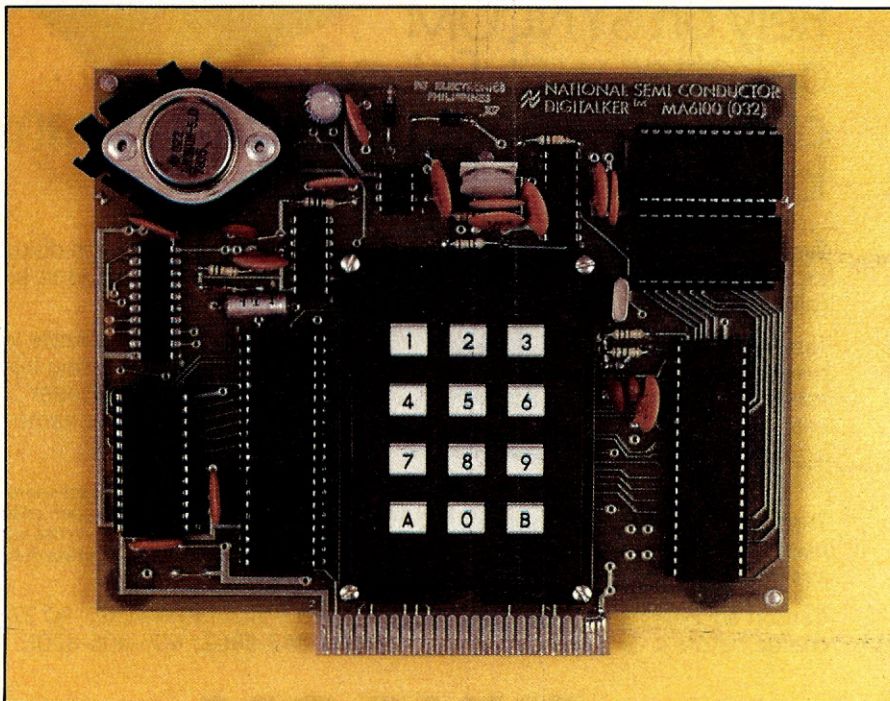
Speech synthesis technology has advanced greatly since my article was published. With the help of LSI (large scale integration) techniques, the price of such speech synthesizers has decreased to the point where we are seeing speech being used to bridge the man-machine gap in such mundane devices as microwave ovens, vending machines and the family car.

This article describes the Speak 'N' Sing 2 synthesizer. It can reproduce high-quality speech, music and sound effects. Speech is reproduced using the National Semiconductor Digitaltalker integrated circuit chip set. If you want to listen to a demonstration, call 408-737-3939.

The heart of the speech synthesizer is the speech processor chip (SPC), which is responsible for decoding the vocabulary stored in external read only memory (ROM). The board contains space for two such ROM sets. The standard ROM set contains 144 words and the optional ROM set contains 131 words.

An additional feature of the Speak 'N' Sing 2 is a 40-word FIFO buffer. This allows the processor to perform other operations while speech is being reproduced. Music and sound synthesis is done using an eight-bit digital-to-analog converter (D/A). The features include:

- High-quality speech
- 40-word FIFO buffer
- Interrupt driver capability
- Music synthesis
- Sound effects
- Audio power amplifier with volume control to drive external speaker
- Balance control to adjust volume of speech and music
- Simultaneous reproduction of music and speech
- Software available on five-inch or eight-inch disk for either 6800 or 6809 processors using Flex
- Hardware available as a board



National Semiconductor offers the evaluation board shown here. The user need only add a 9 V supply and a speaker. Commands are input via the keypad to the on-board microcomputer. The speech processor chip and the word ROMs can be seen on the right side of the board.

Richard Parry [38 W 255 Deerpath Road, Batavia, IL 60510] is an electrical engineer and programmer at the Fermi National Accelerator Lab.

only, in kit form, or assembled and tested.

The Speak 'N' Sing 2 board described here was designed for the SS-50 bus. With a little ingenuity you could adapt the circuit or the board to other systems.

Speech Synthesis

There are several ways that you can program a computer to speak. Waveform digitization was one of the earliest methods developed. It's basically a brute force technique—the word or phrase to be synthesized is first recorded using an analog-to-digital converter (A/D). The digitized data can then be stored in memory, on a disk, magnetic tape or various other storing media.

Reproduction requires the opposite process. The digital information previously stored is played back through a digital-to-analog converter (D/A). Note that the Speak 'N' Sing 2 provides this method of reproducing speech or, for that matter, any other sound. But first you must digitize the audio signal using a separate A/D converter; once digitized, the D/A converter on the Speak 'N' Sing 2 board can be used to reproduce the original audio signal with exceptional quality.

This method of speech synthesis has the advantage of preserving the original speaker's voice and inflection with high fidelity. In fact, the music recording industry is increasingly using digital audio tape recorders because of their superiority over conventional analog tape recorders.

Unfortunately, the technique requires a great deal of memory. To understand why, you must understand how the speech is recorded. Digitizing the signal requires that you sample the original waveform. For good sound reproduction, the sampling rate must be at least twice the highest frequency that you want to reproduce accurately. This is referred to as the Nyquist rate. To record a male speaker, 10 kHz is an acceptable rate for high-quality recording. Recording a female's or child's voice typically requires a higher sampling rate.

Using a ten-bit A/D converter with a sampling rate of 10 kHz, a minute of speech would require nearly a megabyte of memory. This represents a bit rate of 100 Kbps (kilobits per second). Few, if any, low-cost computer systems can afford a megabyte to record a minute of speech. Obviously the

Speak 'N' Sing 2 was
designed for the SS-50
bus. With a little
ingenuity you could
adapt it to other systems.

sampling rate or the A/D resolution can be decreased to reduce the bit rate, but this results in lower-quality speech; the trick is to reduce the bit rate without significantly altering the quality.

Other techniques such as pulse code modulation (PCM), differential PCM, delta modulation, continuous variable slope delta modulation and adaptive predictive coding can reduce the bit rate to approximately 30 Kbps. While certainly better, it is not quite good enough.

However, through computer analysis and compression, the bit rate can be reduced to approximately 1000 bps while still keeping speech fidelity. Bit rates as low as 60 to 90 bps are possible using phoneme synthesis, but the speech sounds more like Donald Duck than a human.

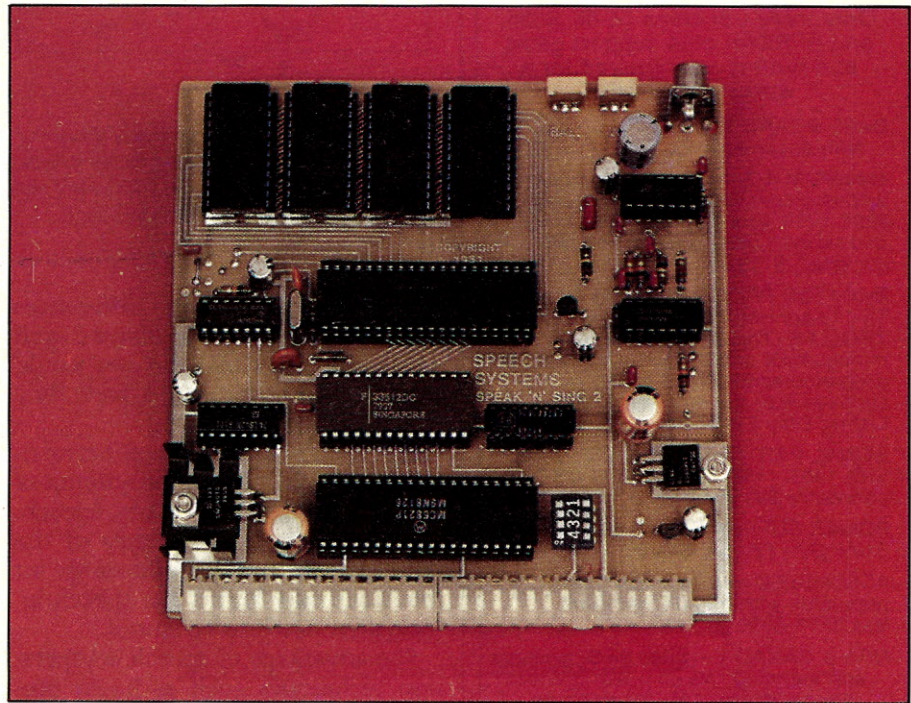
One of the more popular compression techniques is called linear predictive coding. If you've listened to

the Texas Instruments Speak & Spell educational toy, you've heard this method in action. This technique makes it possible to encode speech with relatively little data. The name comes from the fact that LPC uses previous conditions to predict present values for filter coefficients.

The speech synthesis method used by the Speak 'N' Sing 2 is called time domain synthesis, a technique developed by Forrest Mozer. Mozer went into the field to develop a talking calculator for a blind student. The results of his efforts have benefited us all. The heart of the circuit is a speech processor chip which can address up to 128 kilobits of ROM directly. The SPC uses a speech compression technique that reduces the amount of memory needed to store speech by removing the redundant data from the speech signal. Four major methods to do this are:

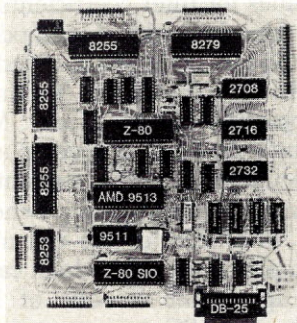
1. Elimination of redundant pitch periods
2. Adaptive delta modulation coding to minimize bandwidth and memory requirements
3. Phase angle adjustments to create mirror image symmetry
4. Replacing the low-level portion of a pitch period with silence.

Figs. 1, 2 and 3 show the differences between the original waveform of the word "zone" and the digitized version after compression.



The Speak 'N' Sing 2. The four chips at the top of the board are the two ROM sets that contain a total of 275 words. Below these chips is the speech processor chip which decodes the words in the ROMs. Below the SPC is the 40-word FIFO buffer.

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The MASTER CONTROLLER BOARD contains:

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- 12K-EPROM: three sockets for 2708, 2716, 2732
- 2K-RAM: 2114s
- 8-Sixteen bit counter timer channels: one 8253 and one AMD 9513
- 2-Serial I/O ports; one Z-80 SIO chip. One port has an RS-232 interface and connector.
- 1-High speed arithmetic processor: AMD 9511

All the I/O chips are memory mapped AND I/O mapped. A bus expansion connector is provided. Can be operated on 5 volts only.

All this on one board less than nine inches on a side

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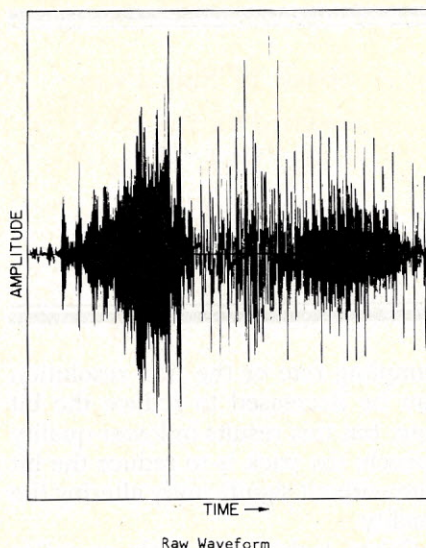
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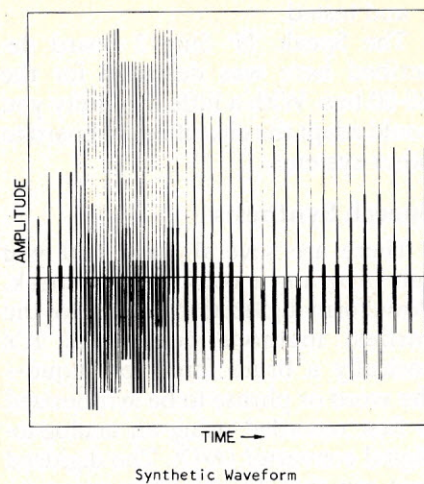
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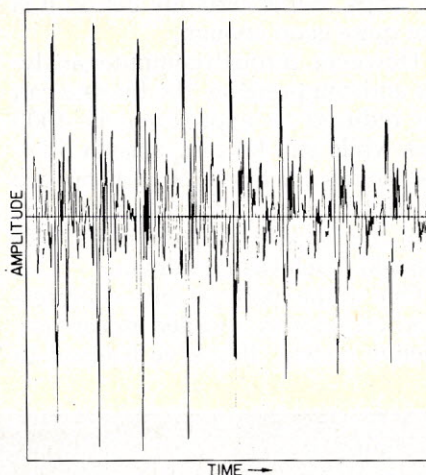
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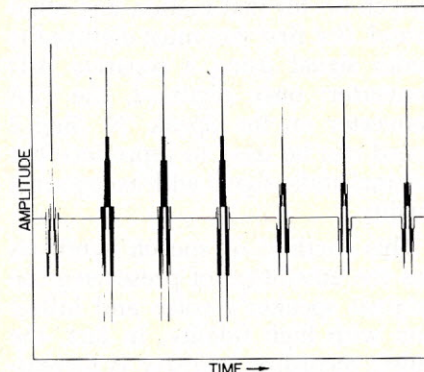
Raw Waveform



Synthetic Waveform



Raw Waveform



Synthetic Waveform

Fig. 2. An exploded view of a portion of the analog and digital waveshape of the word "zone." Once again there are vast differences between the waveshapes. Note the dead silence between the pulses of the digitized waveshape on the right, and the lack of prolonged silence in the analog representation on the left. (Courtesy of National Semiconductor, Inc.)

Fig. 1 vividly shows the differences between the two waveforms, and you might think that the two would sound quite different; in fact, they sound the same.

Fig. 2 shows the silence between pulses, which reduces the amount of information required to store speech. Fig. 3 shows the symmetry of the pulses, which further reduces the bit rate since only half of the speech information needs to be stored.

The advantage of speech compression techniques such as linear predictive coding and time domain synthesis is that both reproduce high-quality speech while drastically reducing the amount of memory re-

quired to store the speech. The memory required is sufficiently reduced to make storing words in high-density ROMs practical. A typical 8K-byte ROM can contain a full minute of high-quality speech. Pre-recorded ROMs which contain many standard or commonly used words are available.

Speech Programming

Now I'll discuss some general rules and comments for programming speech using the Speak 'N' Sing 2. You program speech by transmitting a code for each word you want to reproduce. The code for each word is shown in Table 1. The standard ROM

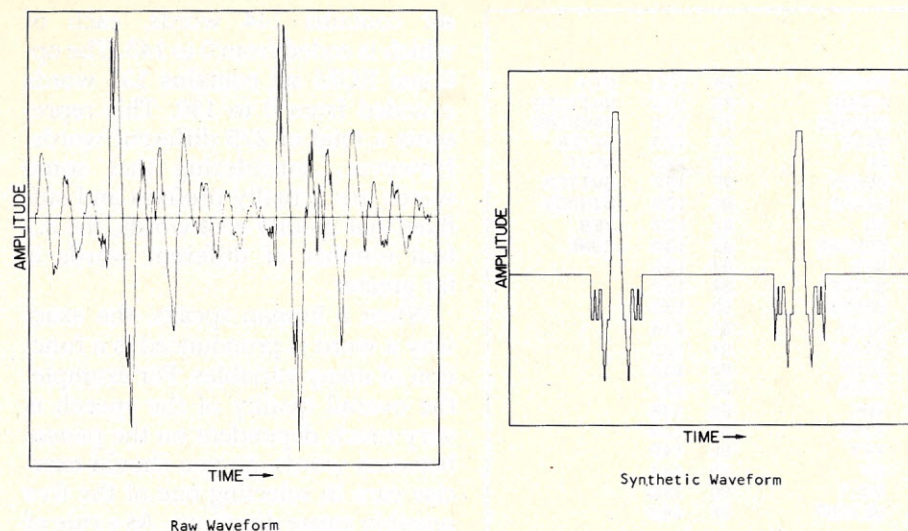


Fig. 3. A minute portion of the word "zone" in an even more exploded view. Again there are marked differences between the two waveshapes that to the human ear sound the same. The interesting point here is that the digital representation of the waveshape on the right is symmetrical. It is through this symmetry and other techniques that you can compress speech by several orders of magnitude. (Courtesy of National Semiconductor, Inc.)

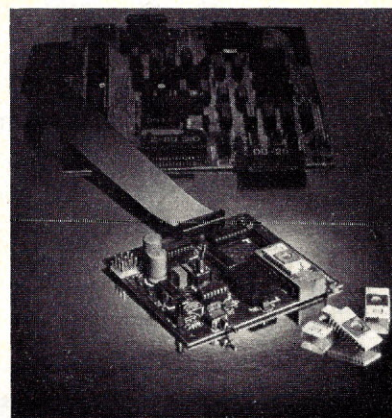
Table 1. Shown here is the root vocabulary contained in the standard and optional ROM sets. Note that several of the words are actually suffixes which may be appended to other words.

ROM SET 1	HEX	DEC	ROM SET 2	ROM SET 1	HEX	DEC	ROM SET 2
THIS IS -	00	00	ABORT	CENTI	48	72	MORE
ONE	01	01	ADD	CHECK	49	73	MOVE
TWO	02	02	ADJUST	COMMA	4A	74	NANO
THREE	03	03	ALARM	CONTROL	4B	75	NEED
FOUR	04	04	ALERT	DANGER	4C	76	NEXT
FIVE	05	05	ALL	DEGREE	4D	77	NO
SIX	06	06	ASK	DOLLAR	4E	78	NORMAL
SEVEN	07	07	ASSISTANCE	DOWN	4F	79	NORTH
EIGHT	08	08	ATTENTION	EQUAL	50	80	NOT
NINE	09	09	BRAKE	ERROR	51	81	NOTICE
TEN	0A	10	BUTTON	FEET	52	82	OHMS
ELEVEN	0B	11	BUY	FLOW	53	83	ONWARD
TWELVE	0C	12	CALL	FUEL	54	84	OPEN
THIRTEEN	0D	13	CAUTION	GALLON	55	85	OPERATOR
FOURTEEN	0E	14	CHANGE	GO	56	86	OR
FIFTEEN	0F	15	CIRCUIT	GRAM	57	87	PASS
SIXTEEN	10	16	CLEAR	GREAT	58	88	PER
SEVENTEEN	11	17	CLOSE	GREATER	59	89	PICO
EIGHTEEN	12	18	COMPLETE	HAVE	5A	90	PLACE
NINETEEN	13	19	CONNECT	HIGH	5B	91	PRESS
TWENTY	14	20	CONTINUE	HIGHER	5C	92	PRESSURE
THIRTY	15	21	COPY	HOUR	5D	93	QUARTER
FOURTY	16	22	CORRECT	IN	5E	94	RANGE
FIFTY	17	23	DATE	INCHES	5F	95	REACH
SIXTY	18	24	DAY	IS	60	96	RECEIVE
SEVENTY	19	25	DECREASE	IT	61	97	RECORD
EIGHTY	1A	26	DEPOSIT	KILO	62	98	REPLACE
NINETY	1B	27	DIAL	LEFT	63	99	REVERSE
HUNDRED	1C	28	DIVIDE	LESS	64	100	ROOM
THOUSAND	1D	29	DOOR	LESSER	65	101	SAVE
MILLION	1E	30	EAST	LIMIT	66	102	SECURE
ZERO	1F	31	(T)ED	LOW	67	103	SELECT
A	20	32	(D)ED	LOWER	68	104	SEND
B	21	33	(K)ED	MARK	69	105	SERVICE
C	22	34	(-)ED	METER	6A	106	SIDE
D	23	35	EMERGENCY	MILE	6B	107	SLOW
E	24	36	END	MILI	6C	108	SLOWER
F	25	37	ENTER	MINUS	6D	109	SMOKE
G	26	38	ENTRY	MINUTE	6E	110	SOUTH
H	27	39	ER	NEAR	6F	111	STATION
I	28	40	EVACUATE	NUMBER	70	112	SWITCH
J	29	41	EXIT	OF	71	113	SYSTEM
K	2A	42	FAIL	OFF	72	114	TEST
L	2B	43	FAILURE	ON	73	115	TH
M	2C	44	FARAD	OUT	74	116	THANK
N	2D	45	FAST	OVER	75	117	THIRD
O	2E	46	FASTER	PARENTHESIS	76	118	THIS
P	2F	47	FIFTH	PERCENT	77	119	TOTAL
Q	30	48	FIRE	PLEASE	78	120	TURN
R	31	49	FIRST	PLUS	79	121	USE

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Table 1 continued.

S	32	50	FLOOR	POINT	7A	122	UTH
T	33	51	FORWARD	POUND	7B	123	WAITING
U	34	52	FROM	PULSES	7C	124	WARNING
V	35	53	GAS	RATE	7D	125	WATER
W	36	54	GET	RE	7E	126	WEST
X	37	55	GOING	READY	7F	127	SWITCH
Y	38	56	HALF	RIGHT	80	128	WINDOW
Z	39	57	HELLO	SS	81	129	YES
AGAIN	3A	58	HELP	SECOND	82	130	ZONE
AMPERE	3B	59	HERTZ	SET	83	131	
AND	3C	60	HOLD	SPACE	84	132	
AT	3D	61	INCORRECT	SPEED	85	133	
CANCEL	3E	62	INCREASE	STAR	86	134	
CASE	3F	63	INTRUDER	START	87	135	
CENT	40	64	JUST	STOP	88	136	
400 HZ	41	65	KEY	THAN	89	137	
80 HZ	42	66	LEVEL	THE	8A	138	
20 MS	43	67	LOAD	TIME	8B	139	
40 MS	44	68	LOCK	TRY	8C	140	
80 MS	45	69	MEG	UP	8D	141	
160 MS	46	70	MEGA	VOLT	8E	142	
320 MS	47	71	MICRO	WEIGHT	8F	143	

Listing 1. Have you ever wanted to play bingo but didn't want to be the caller? This program lets the Speak 'N' Sing 2 do the announcing.

```

100 REM BINGO
110 REM SPEECH PORT
120 P0=HEX("8008")
130 P1=P0+1
140 P2=P0+2
150 P3=P0+3
160 REM INITIALIZE SPEECH PORT
170 POKE P1,0
180 POKE P3,0
190 POKE P2,255 : REM B PORT ALL OUTPUTS
200 POKE P1,62 : REM $3E SELECT STANDARD ROM SET
210 POKE P3,46 : REM $2E AUTO STROBE
220 X=PEEK(P0) : REM CLEAR HANDSHAKE FLAG BIT
230 POKE P2,71 : REM START TOGGLE "PAUSE"
240 REM *****
250 REM * PORT INITIALIZATION COMPLETE, START MAIN PROGRAM *
260 REM *****
270 INPUT "SECONDS PAUSE BETWEEN ANNOUNCEMENTS", K
280 INPUT "ANNOUNCE EACH CLUE TWICE (Y/N)", Q$
290 DIM N(75)
300 REM FILL ARRAY IN NUMBERS 1 TO 75
310 FOR I = 1 TO 75
320 N(I) = I
330 NEXT I
340 REM SCRABBLE ARRAY
350 FOR I = 1 TO 75
360 R = INT(74*RND(0)+1.5)
370 T = N(I)
380 N(I) = N(R)
390 N(R) = T
400 NEXT I
410 REM *****
420 REM * SHUFFLING COMPLETE. ANNOUNCE LETTER ALONG WITH NUMBER *
430 REM *****
440 FOR I = 1 TO 75
450 ON INT((N(I)+14)/15) GOTO 460,470,480,490,500
460 PRINT "B";:RESTORE 920:GOTO 510
470 PRINT "I";:RESTORE 930:GOTO 510
480 PRINT "N";:RESTORE 940:GOTO 510
490 PRINT "G";:RESTORE 950:GOTO 510
500 PRINT "O";:RESTORE 960:GOTO 510
510 PRINT N(I),
520 IF I/5 = INT(I/5) THEN PRINT
530 GOSUB 800
540 X9 = N(I)
550 GOSUB 1290
560 REM REPEAT IF REQUESTED
570 IF LEFT$(Q$,1) = "N" THEN 700
580 RESTORE 980
590 GOSUB 800
600 ON INT((N(I)+14)/15) GOTO 610,620,630,640,650
610 RESTORE 920:GOTO 660
620 RESTORE 930:GOTO 660
630 RESTORE 940:GOTO 660
640 RESTORE 950:GOTO 660
650 RESTORE 960:GOTO 660
660 GOSUB 800
670 X9 = N(I)
680 GOSUB 1290

```

set contains 144 words, each of which is coded from 0 to 143. The optional ROM set contains 131 words encoded from 0 to 130. This represents a total of 275 different words. However, considering that some words are actually prefixes and suffixes that modify root words, the actual number of different words is far greater.

When a human speaks, the exact way a word is pronounced is a function of many variables. For example, the overall quality of the speech is very much dependent on the pauses between words. So you should exercise care in selecting one of the five possible pause durations. As a rule of thumb, for words beginning with the letters k, t, p, b, d and g, insert an 80 ms pause prior to the words; for words ending in those letters, insert a 40 ms pause following the word.

The standard ROM contains the "ss" sound; this suffix can be used to pluralize many words. Therefore, abort can be easily changed to aborts by appending the "ss" suffix to the root word.

The optional ROM set contains several additional sounds that can be used to modify many words. For example, the "th" suffix can be used to change six, seven and eight to sixth, seventh and eighth. The "uth" sound can be added to words like twenty, thirty and forty to form the adjectives twentieth, thirtieth and fortieth.

Also available in the optional ROM set are four forms of the "ed" suffix, used to change a present-tense word to its past-tense form. Four forms are available because the way we say "ed" varies from word to word. Experimenting with each of the "ed" sounds will let you develop the best-quality results. As a guideline, address 31 "ed" or 32 "ed" should be used with words ending in T or D, such as bat or seed. Address 34 "ed" can be used with words ending with a soft sound, such as ask.

Software

This section will show you how to write a 6800 assembly-language program and a Basic program to reproduce speech. For the sake of our examples, the board memory address is 8008 (hexadecimal), which represents port #2 in most 6800 systems. Because of the FIFO (first in, first out) feature of the Speak 'N' Sing 2, there are two methods of determining if the synthesizer is ready for the next word.

Listing 1 continued.

```

690 REM PAUSE BETWEEN VALUES
700 FOR J = 1 TO K
710 RESTORE 1000
720 GOSUB 800
730 NEXT J
740 NEXT I
750 END
760 REM *****
770 REM * THIS ROUTINE WILL OUTPUT A PHRASE UNTIL A 255 IS *
780 REM * WHICH DENOTES THE END OF THE PHRASE. *
790 REM *****
800 X4 = PEEK(P1) : REM CHECK STATUS REGISTER FOR READY
810 IF X4 < 128 THEN 800
820 READ X4
830 IF X4=255 THEN 870 : REM END OF PHRASE
840 X8=PEEK(P0) : REM CLEAR READY FLAG BIT
850 POKE P2,X4 : REM STORE WORD
860 GOTO 800
870 RETURN
880 REM *****
890 REM * BEGINNING OF LETTERS, PAUSES AND NUMBERS TO BE SPOKEN *
900 REM *****
910 REM FIVE LETTERS "B I N G O"
920 DATA 33,255
930 DATA 40,255
940 DATA 45,255
950 DATA 38,255
960 DATA 46,255
970 REM .2 SECOND PAUSE
980 DATA 67,69,67,69,255
990 REM 1 SECOND OF PAUSES
1000 DATA 71,71,71,68,255
1010 REM 1-9
1020 DATA 1,255
1030 DATA 2,255
1040 DATA 3,255
1050 DATA 4,255
1060 DATA 5,255
1070 DATA 6,255
1080 DATA 7,255
1090 DATA 8,255
1100 DATA 9,255
1110 REM TEN - NINETEEN
1120 DATA 10,255
1130 DATA 11,255
1140 DATA 12,255
1150 DATA 13,255
1160 DATA 14,255
1170 DATA 15,255
1180 DATA 16,255
1190 DATA 17,255
1200 DATA 18,255
1210 DATA 19,255
1220 REM TWENTY - SEVENTY
1230 DATA 20,255
1240 DATA 21,255
1250 DATA 22,255
1260 DATA 23,255
1270 DATA 24,255
1280 DATA 25,255
1290 REM SAY NUMBER IN X9
1300 IF X9<10 THEN 1620
1310 IF X9<20 THEN 1480
1320 X5=X9
1330 X9=INT(X9/10)
1340 REM X9 >= 20
1350 ON X9 GOTO 1350,1360,1370,1380,1390,1400,1410,1420,1430
1360 RESTORE 1230:GOTO 1440
1370 RESTORE 1240:GOTO 1440
1380 RESTORE 1250:GOTO 1440
1390 RESTORE 1260:GOTO 1440
1400 RESTORE 1270:GOTO 1440
1410 RESTORE 1280:GOTO 1440
1420 RESTORE 4960:GOTO 1440
1430 RESTORE 4980
1440 GOSUB 800
1450 X9=X5-INT(X5/10)*10
1460 GOTO 1620
1470 REM X9 < 20
1480 ON X9-9 GOTO 1490,1500,1510,1520,1530,1540,1550,1560,1570,1580
1490 RESTORE 1120:GOTO 1590
1500 RESTORE 1130:GOTO 1590
1510 RESTORE 1140:GOTO 1590
1520 RESTORE 1150:GOTO 1590
1530 RESTORE 1160:GOTO 1590
1540 RESTORE 1170:GOTO 1590
1550 RESTORE 1180:GOTO 1590
1560 RESTORE 1190:GOTO 1590

```

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Listing 1 continued.

```

1570 RESTORE 1200:GOTO 1590
1580 RESTORE 1210
1590 GOSUB 800
1600 GOTO 1730
1610 REM X9 < 10
1620 ON X9+1 GOTO 1730,1630,1640,1650,1660,1670,1680,1690,1700,1710
1630 RESTORE 1020:GOTO 1720
1640 RESTORE 1030:GOTO 1720
1650 RESTORE 1040:GOTO 1720
1660 RESTORE 1050:GOTO 1720
1670 RESTORE 1060:GOTO 1720
1680 RESTORE 1070:GOTO 1720
1690 RESTORE 1080:GOTO 1720
1700 RESTORE 1090:GOTO 1720
1710 RESTORE 1100
1720 GOSUB 800
1730 RETURN

```

Listing 2. This 6800 machine-language program shows how you can reproduce a phrase that uses words in both the standard and optional ROM sets.

```

1      NAM      TALK2ROM
2      *****
3      *
4      * THIS PROGRAM WILL ALLOW THE SPEAK 'N' SING 2 BOARD TO *
5      * SPEAK A PHARSE FROM BOTH THE ST&ARD AND OPTIONAL WORD *
6      * ROMS. EACH WORD IN THE PHARSE TO BE SPOKEN IS *
7      * REPRESENTED BY 2 BYTES. THE FIRST BYTE DENOTES THE ROM *
8      * SET (0 = ST&ARDIARY, 1 = OPTIONAL VOC&ULARY). *
9      * THE SECOND BYTE INDICATES THE ACTUAL WORD. *
10     * THE END OF THE PHARSE IS NOTED BY A 255. *
11     *****
12     8008      PORT      EQU      $8008
13     AD03      WARMS     EQU      $AD03
14     *
15     A100      ORG       $A100
16     A100 CE 80 08 START LDX      $PORT
17     A103 6F 01      CLR      1,X
18     A105 6F 03      CLR      3,X
19     A107 86 FF      LDA      A,$FF
20     A109 A7 00      STA      A,0,X
21     A10B A7 02      STA      A,2,X
22     A10D 86 3E      LDA      A,$3E
23     A10F A7 01      STA      A,1,X
24     A111 86 2F      LDA      A,$2F
25     A113 A7 03      STA      A,3,X
26     A115 6D 00      TST      0,X
27     A117 6D 02      TST      2,X
28     A119 86 43      LDA      A,$43
29     A11B A7 02      STA      A,2,X
30     * MAIN ROUTINE
31     A11D CE A1 4F LDX      $PHRASE
32     A120 A6 00      MORE     LDA      A,0,X
33     A122 81 FF      CMP      A,$255
34     A124 27 18      -        BEQ      END
35     A126 6D 00      NOTEOT   TST      0,X
36     A128 26 07      BNE      NOSTND
37     A12A C6 3E      LDA      B,$3E
38     A12C F7 80 09      STA      B,PORT+1
39     A12F 20 05      BRA      CONTIN
40     A131 C6 36      NOSTND   LDA      B,$36
41     A133 F7 80 09      STA      B,PORT+1
42     A136 08      CONTIN    INX
43     A137 A6 00      LDA      A,0,X
44     A139 8D 06      BSR      SPEAK
45     A13B 08      INX
46     A13C 20 E2      BRA      MORE
47     A13E 7F AD 03 END      JMP      WARMS
48     * ROUTINE TO SPEAK WORD
49     A141 36      SPEAK     PSH      A
50     A142 86 80 09 NOTRDY   LDA      A,PORT+1
51     A145 2A FB      BPL      NOTRDY
52     A147 7D 80 08      TST      PORT
53     A14A 32      PUL      A
54     A14B 87 80 0A      STA      A,PORT+2
55     A14E 39      RTS
56     *****
57     * ATTENTION, ATTENTION *
58     * FIRE ON THE FIRST, SECOND, AND THIRD FLOORS. *
59     * GO TO THE NORTH OR SOUTH EXITS. *
60     * THIS IS NOT A TEST! *
61     *****
62     A14F 01      PHRASE    FCB      1,8,0,70,1,8,0,71
63     A150 08 00
64     A152 46 01
65     A154 08 00
66     A156 47
67     A157 01      FCB      1,48,0,115,1,49,0,130,0,60,1,117
68     A158 30 00

```

In some cases you'll want to synchronize the word being spoken with some event (such as a word or phrase being written at the computer's monitor). To do this you must bypass the FIFO buffer, by interrogating the CA1 line of the peripheral interface adapter (PIA U1). The schematic in Fig. 5 shows that this line of the PIA is connected directly to the SPC.

However, in most cases you'll want to take advantage of the FIFO by interrogating the status of the CB1 handshake line of the PIA. This line is connected to the SPC via the FIFO buffer. By using the FIFO you can store up to 40 words within a very short time and then proceed with processing other data while the words are spoken.

The buffer can store and reproduce approximately 20 seconds of speech without intervention from the host processor. If more than 40 words need to be stored and the processor must perform other tasks while

Synthesizing music
is really not all
that different from
synthesizing sound
effects—after all,
music is just sound
and silence.

words are being produced, a large buffer can be developed in the host computer's memory and driven by interrupts. However, in most cases you should find the 40-word speech buffer adequate.

An additional comment is worthy of note. The CA1 and CB1 lines of a PIA are triggered by transitions (i.e., high to low or low to high) rather than levels. This means that the PIA will not indicate that the circuit is ready for the first word, even though it actually is, because a transition has not occurred. For this reason a pause (\$43) is sent to the speech synthesizer to, in essence, reboot the synthesizer.

A particular ROM set is selected by the CA2 output line of the PIA. If this line is high, the standard ROM set is selected. When CA2 is low, the optional ROM is selected. From a programming standpoint, the standard ROM set is selected by storing a 3E (hex) or 62 (dec) at the A port of the PIA. The optional ROM set is se-

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Listing 2 continued.

```

A15A 73 01
A15C 31 00
A15E 82 00
A160 3C 01
A162 75
64 A163 01          FCB    1,50,0,129,0,71
   A164 32 00
   A166 81 00
   A168 47
65 A169 00          FCB    0,86,0,2,0,138,1,79,1,86,1,110,1,41,0,129
   A16A 56 00
   A16C 02 00
   A16E 8A 01
   A170 4F 01
   A172 56 01
   A174 6E 01
   A176 29 00
   A178 81
66 A179 00          FCB    0,71,1,118,0,96,1,80,0,32,1,114
   A17A 47 01
   A17C 76 00
   A17E 60 01
   A180 50 00
   A182 20 01
   A184 72
67 A185 FF          FCB    255
68
69          *          END    START

```

Listing 3. This program simulates the sound of a plane as it passes overhead. The effect is accomplished by amplitude modulating noise, and the noise is synthesized by using a random number generator.

```

1          NAM      PLANE
2          *****
3          *
4          * THIS SOUND EFFECTS PROGRAM SYNTHESIZES THE SOUND OF A *
5          * PLANE BY CONTROLLING THE AMPLITUDE OF WHITE NOISE. *

```

More

lected by storing 36 (hex) or 54 (dec).

Listing 1 shows a Basic program that plays the game of bingo. The synthesizer announces each bingo tile that is picked at random. In this way, everyone can play the game and no one is stuck announcing. The program lets the players determine the length of time between announcements. You can also tell the synthesizer to speak each call twice.

As each call is spoken, it appears at the monitor to allow verification after the game is over. Note that this is an example of a case in which you don't want to use the buffer—you want the call to appear at the monitor as it is spoken. For this reason, the CA1 handshake line is used.

Listing 2 shows a 6800 machine-language program. Unlike the bingo program, which uses only the standard ROM set, this program produces a phrase that comprises words from both the standard as well as the optional ROM set. In order to accomplish this, each word is represented by two bytes. The first byte indicates which ROM contains the word, while the second represents the word code. If the first byte is a 0, the stan-

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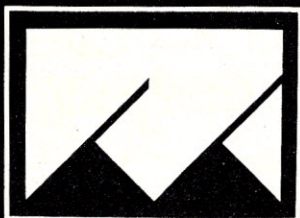
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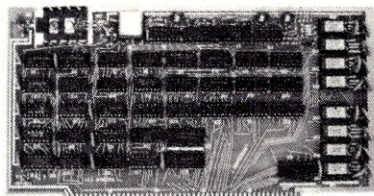
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dard ROM set is selected; if it's a 1, the optional ROM set is selected. After the proper ROM is selected, the word code is stored.

Sound Effects and Music

Space does not allow room for an in-depth discussion into the fascinating field of music and sound effect synthesis. However, the example program and the following discussion should provide a good introduction.

The Plane program shown in Listing 3 produces nothing more than amplitude modulated white noise. The heart of the noise is a random number generator. The amplitude of this noise is determined by an envelope waveshape given in a table. As the plane approaches the listener, the noise amplitude is increased. As the plane passes overhead, the noise reaches its maximum loudness, and slowly decreases as the plane moves into the sunset. Noise is an important sound effect that can be used to simulate thunderstorms and gunshots. Bear in mind that creativity is the key to good sound effect programming.

Synthesizing music is really not all

Listing 3 continued.

```

6          * CONTROL RETURNS TO FLEX AT END OF PROGRAM.
7          *****
8 8008      PORT EQU $8008      SS-1 PORT
9 AD03      WARMS EQU $AD03
10 002F      FREQ EQU $2F      TIME BETWEEN NOISE PULSES
11 00FE      DURA EQU $FE      NUMBER OF RANDOM PULSES
12          *
13 A100      ORG $A100
14 A100 7E A1 05 START JMP START1
15 A103      HIB RMB 1          HIB OF RNG
16 A104      LOB RMB 1          LOB OF RNG
17 A105 CE 80 08 START1 LDX $PORT
18 A108 6F 01 CLR 1,X
19 A10A 86 FF LDA A $FF
20 A10C A7 00 STA A 0,X      A PORT ALL OUTPUTS
21 A10E 86 04 LDA A $4
22 A110 A7 01 STA A 1,X
23 A112 CE A1 53 LDX $ENVELOP AMPLITUDE MOD. POINTER
24 A115 A6 00 AGN2 LDA A 0,X    END OF ENVELOP ?
25 A117 81 04 CMP A $4
26 A119 26 03 BNE NOTEND
27 A11B 7E AD 03 JMP WARMS     RETURN TO FLEX
28 A11E 08 NOTEND INX
29 A11F C6 FE LDA B $DURA     OUTPUT N RANDOM VALUES
30 A121 86 2F AGN1 LDA A $FREQ DELAY
31 A123 4A AGN3 DEC A
32 A124 26 FB BNE AGN3
33 A126 8D 0A BSR RANDOM      GET RANDOM NUMBER IN ACC A
34 A128 A4 00 AND A 0,X
35 A12A B7 80 08 STA A PORT   OUTPUT TO SS-1 D/A CONVERTER
36 A12D 5A DEC B
37 A12E 26 F1 BNE AGN1
38 A130 20 E3 BRA AGN2        GET NEXT AMPLITUDE VALUE
39          * RANDOM NUMBER GENERATOR. RESULT IN ACC A
40 A132 B6 A1 03 RANDOM LDA A HIB
41 A135 46 ROR A
42 A136 B8 A1 03 EOR A HIB
43 A139 46 ROR A
44 A13A 46 ROR A
45 A13B B8 A1 03 EOR A HIB
46 A13E 46 ROR A
47 A13F B8 A1 04 EOR A 1,0B
48 A142 46 ROR A
49 A143 46 ROR A

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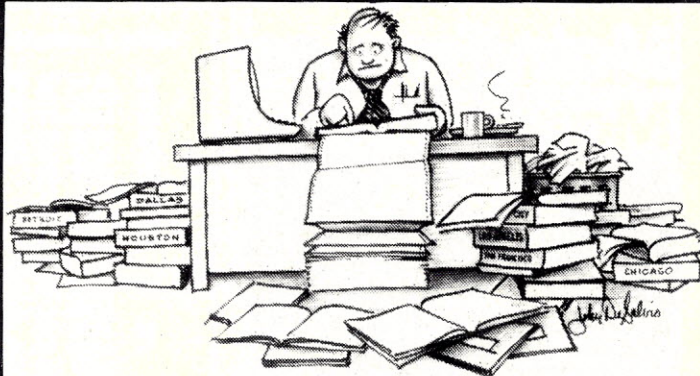
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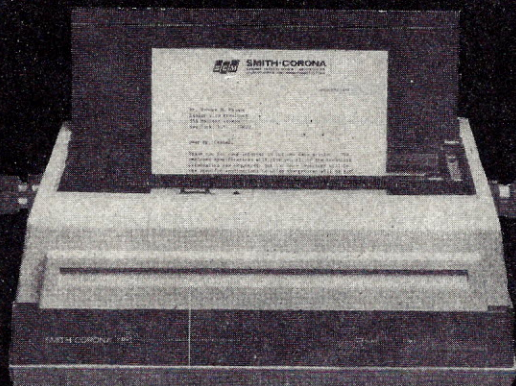
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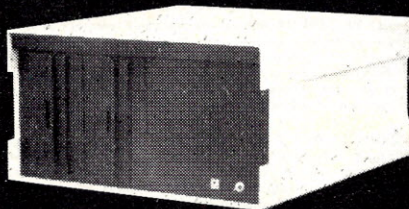
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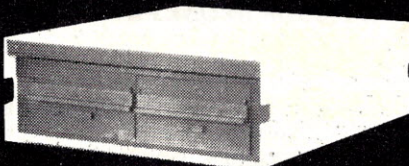
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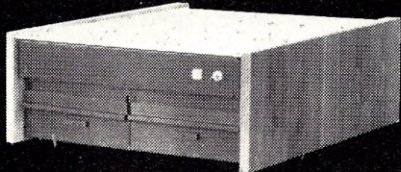
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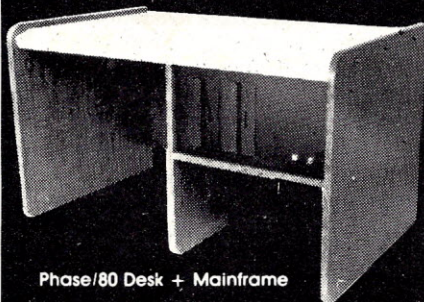
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50	A144 84 02	AND A \$2
51	A146 78 A1 04	ASL LOR
52	A149 79 A1 03	ROL HIR
53	A14C RR A1 04	ADD A LOR
54	A14F 87 A1 04	STA A LOR
55	A152 39	RTS
56		
57		
58	A153 00	* THE FOLLOWING TABLE REPRESENTS THE AMPLITUDE MODULATION
	A154 11 18	* ENVELOPE OF THE RANDOM NOISE.
	A156 20 28	ENVELOP FCB \$0,\$11,\$18,\$20,\$28,\$30,\$38,\$40,\$48
	A158 30 38	
	A15A 40 48	
59	A15C 50	FCB \$50,\$58,\$60,\$68,\$70,\$78,\$80,\$88,\$90,\$98
	A15D 58 60	
	A15F 68 70	
	A161 78 80	
	A163 88 90	
	A165 98	
60	A166 A0	FCB \$A0,\$A8,\$B0,\$B8,\$C0,\$C8,\$D0,\$D8,\$E0,\$E8
	A167 A8 B0	
	A169 B8 C0	
	A16B C8 D0	
	A16D D8 E0	
	A16F E8	
61	A170 F0	FCB \$F0,\$F8,\$FF,\$FF,\$FF,\$FF
	A171 F8 FF	
	A173 FF FF	
	A175 FF	
62	A176 F8	FCB \$F8,\$F0,\$E8,\$E0,\$D8,\$D0,\$C8,\$C0
	A177 F0 E8	
	A179 E0 D8	
	A17B D0 C8	
	A17D C0	
63	A17E B8	FCB \$B8,\$B0,\$A8,\$A0,\$98,\$90,\$88,\$80
	A17F B0 A8	
	A181 A0 98	
	A183 90 88	
	A185 80	
64	A186 78	FCB \$78,\$70,\$68,\$60,\$58,\$50,\$48,\$40
	A187 70 68	
	A189 60 58	
	A18B 50 48	
	A18D 40	
65	A18E 38	FCB \$38,\$38,\$30,\$30,\$28,\$28,\$20,\$20
	A18F 38 30	
	A191 30 28	
	A193 28 20	
	A195 20	
66	A196 20	FCB \$20,\$20,\$20,\$18,\$18,\$18,\$18,\$18
	A197 20 20	
	A199 18 18	
	A19B 18 18	
	A19D 18	
67	A19E 10	FCB \$10,\$10,\$10,\$10,\$10,\$10,\$10,\$10
	A19F 10 10	
	A1A1 10 10	
	A1A3 10 10	
	A1A5 10	
68	A1A6 10	FCB \$10,\$10,\$10,\$10,\$10,\$10,\$10,\$10
	A1A7 10 10	
	A1A9 10 10	
	A1AB 10 10	
	A1AD 10	
69	A1AE 08	FCB 8,8,8,8,8,8,8,8
	A1AF 08 08	
	A1B1 08 08	
	A1B3 08 08	
	A1B5 08	
70	A1B6 08	FCB 8,8,8,8,8,8,8,8
	A1B7 08 08	
	A1B9 08 08	
	A1BB 08 08	
	A1BD 08	
71	A1BE 04	FCB 4
72		END OF TRANSMISSION
73		END START

that different from synthesizing sound effects—after all, music is just sound and silence. A special program called a music interpreter allows the user to write music easily, using music notation. For example, if you wanted to reproduce the half-note C sharp in the first octave, you'd just write C#1H, rather than tediously write a machine-language routine specifying various parameters. If you

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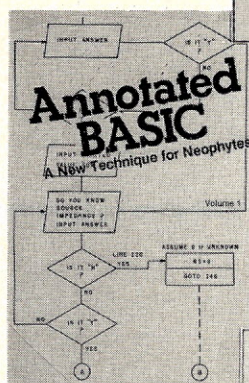
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(U3) driven by the B port of the PIA. (See Fig. 4.)

The digital-to-analog converter is made up of a resistor ladder consisting of 16 resistors neatly packaged in a DIP and labelled RL1 in the sche-

matic (Fig. 5). The output of the converter ranges from approximately 0 to 5 volts. Since the converter is connected to eight lines of the PIA, it is an eight-bit converter which allows 256 different voltages in the specified

range. The D/A circuit is capable of reproducing virtually any sound, including music, sound effects and waveform speech.

The speech portion of the circuit consists of basically four parts: the

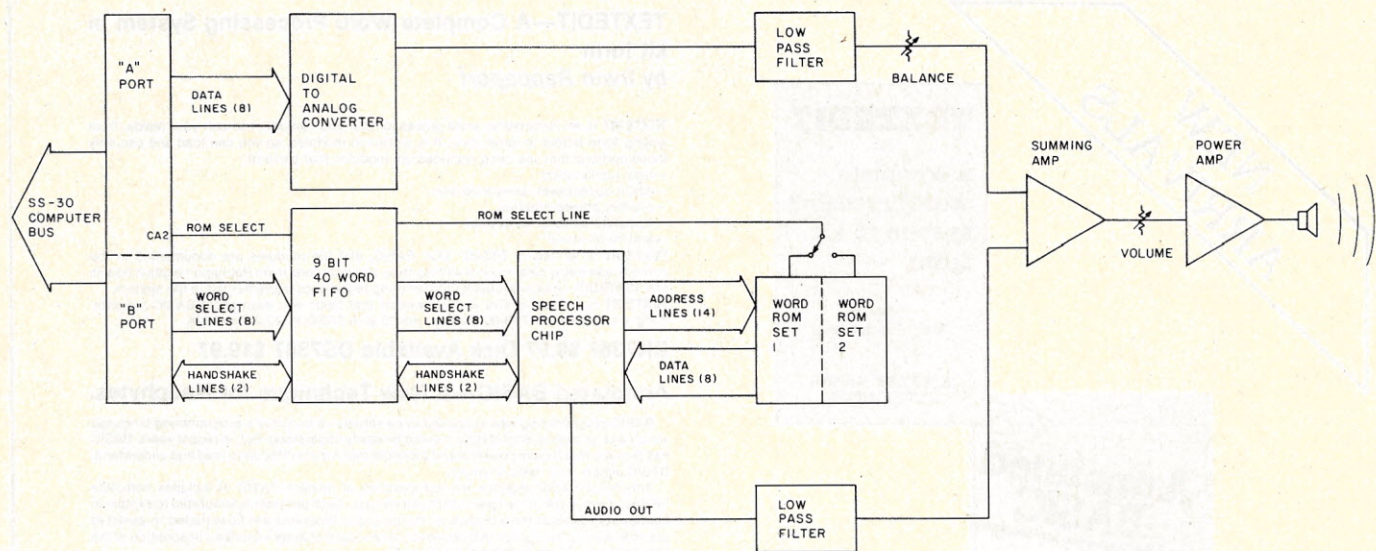


Fig. 4. Block diagram of the Speak 'N' Sing 2. The two major divisions of the synthesizer are the D/A converter, which allows music and sound effect synthesis, and the speech processor, which in conjunction with the word ROMs is responsible for speech synthesis.

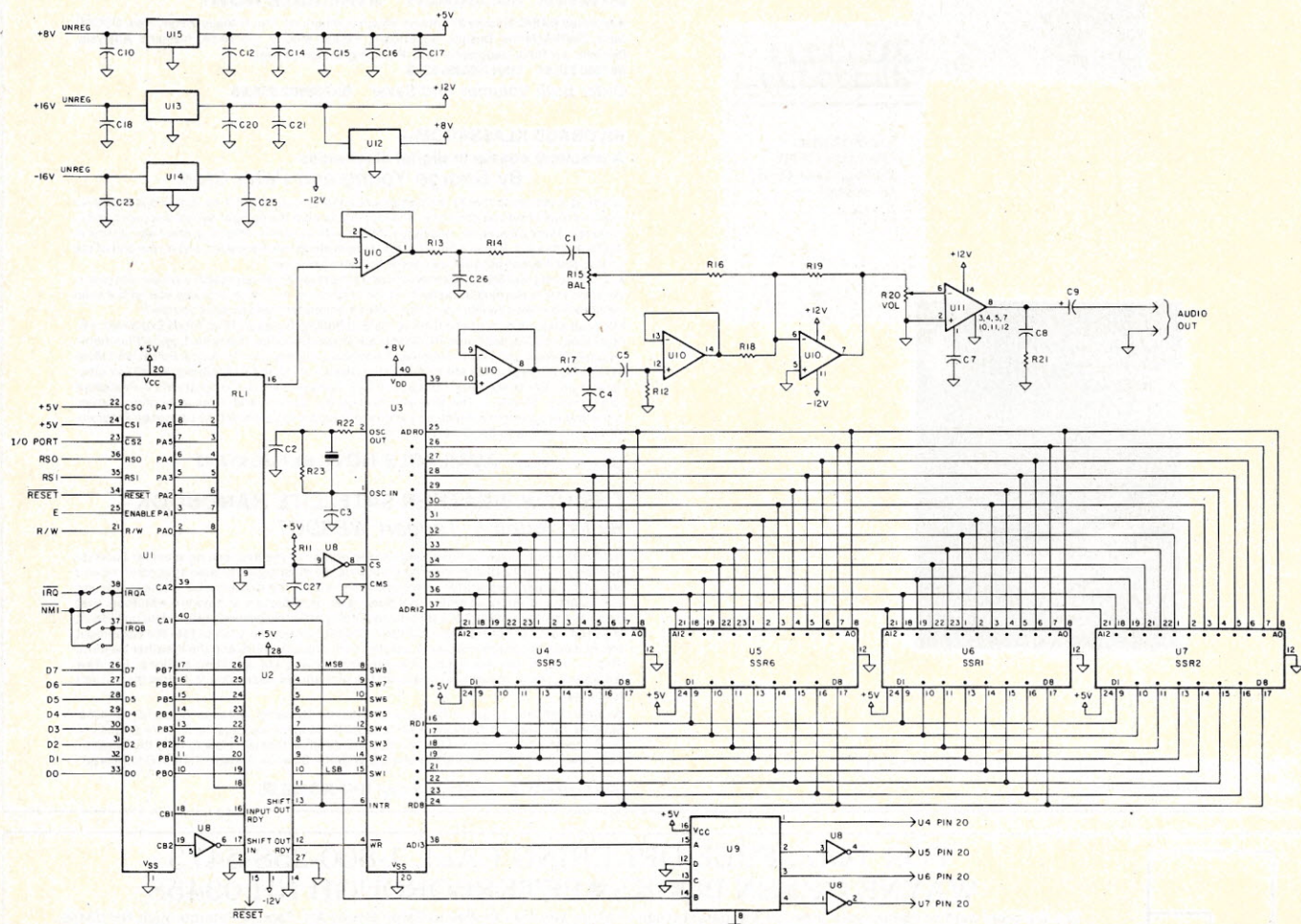
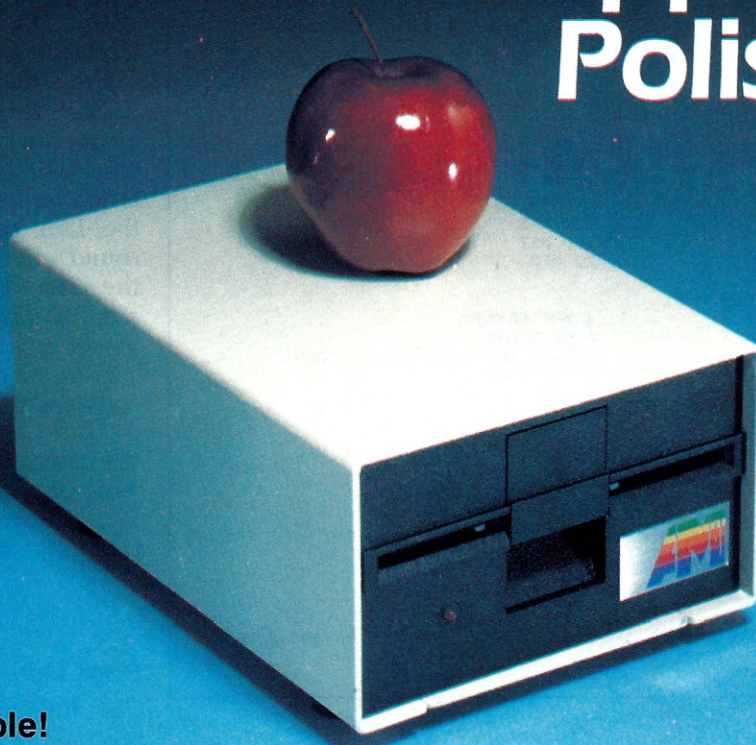


Fig. 5. Complete schematic of the Speak 'N' Sing 2 speech, music and sound effects synthesizer. Integrated circuit U3 is the heart of the speech synthesizer. Words are stored in ROMs U4,5,6,7. The eight-bit D/A converter, responsible for music and speech synthesis, comprises resistor ladder network RL1.

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1	1	U1
2	1	U2
3	1	U3 4 5
4	1	U6 7
5	1	U8
6	1	U9
7	1	U10
8	1	U11
9	1	U12
10	1	U13
11	1	U14
12	1	U15

6821 PIA
33512 40 WORD 9 BIT FIFO
NATIONAL SEMI. DT-1050 3 CHIP SET
NATIONAL SEMI. DT-1057 2 CHIP SET
74LS04 HEX INVERTER
74LS42 4 LINE TO 10 LINE DECODER
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LM 380 2 WATT AUDIO POWER AMP
78L08 8 VOLT POS. REGULATOR
7812 12 VOLT POS. REGULATOR
79L12 12 NEG. REGULATOR
7805 5 VOLT POS. REGULATOR

RESISTORS

13	1	RL1
14	4	R11 16 18 19
15	1	R17
16	2	R12 14
17	2	R15 20
18	2	R13 22
19	1	R21
20	1	R23

RES. LADDER ALLEN BRADLEY 316L08253
10K 1/4 WATT
6.8K 1/4 WATT
100K 1/4 WATT
5K POT BAL & VOL
1.5K 1/4 WATT
2.7 1/4 WATT
1 M 1/4 WATT

CAPACITORS

21	1	C1
22	1	C2
23	1	C3
24	10	C4 5 7 8 14 15 16 17 25 26
25	1	C9
26	2	C10 18
27	5	C12 20 21 23 27

1 MFD
47 PFD
15 PFD
.1 MFD
220 MFD
100 MFD
22 MFD

MISCELLANEOUS

28	1	
29	1	
30	2	
31	1	
32	1	
33	1	
34	3	
35	2	
36	4	
37	1	
38	2	
39	1	
40	2	
41	2	
42	1	

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Parts list. Complete parts list for the Speak 'N' Sing 2. The board is available in kit form as well as tested and assembled.

FIFO buffer (U2), the speech processor chip (U3), the word ROMs (U4 5 6 7) and the driver (PIA, U1). Note

that the FIFO is a nine-bit device. Eight of the bits are used for the word code, while the remaining bit deter-

mines which ROM is selected.

The heart of the speech synthesizer is the speech processor chip (U3). It can reproduce any word in the ROMs. The input to the SPC consists of eight lines, which allows access to a maximum of 256 words. However, codes above 143 for U4 and 5, and codes above 130 for U6 and 7, will give unpredictable results. The CA2 output line of the PIA is used to select a particular pair of ROMs. If CA2 is high, U4 and 5 will be selected; ROMs U6 and 7 will be selected if CA2 is low.

The remaining circuitry, consisting mainly of U10 and U11, is responsible for audio summing and amplification. U10 is connected as a summing amplifier to sum the output signal of the D/A converter (i.e., music or sound effects) and the speech synthesizer. These signals are then amplified by U11, which is an audio power amplifier.

Two control potentiometers are conveniently placed at the edge of the pc board to allow the user to control the volume of music and speech. Note that the potentiometer marked BAL controls only the volume of the music. ■

Price List

The following items are available postpaid in the U.S. Overseas orders add \$12 postage.

All Speak 'N' Sing 2 prices include the standard ROM set only; the optional ROM set must be purchased separately.

Speech Systems
38 W 255 Deerpath Road
Batavia, IL 60510

Speak 'N' Sing 2, blank printed circuit board, \$39.

Speak 'N' Sing 2, semi-kit (board, U3 U4 U5, crystal, RL1), \$129.

Speak 'N' Sing 2, kit form (all components), \$189.

Speak 'N' Sing 2, assembled and tested, \$229.

Optional ROM set, 131 additional words, \$49.

Software including speech-based games, music and sound effects in Flex 1.0, 2.0 or Flex 9.0 is available on five-inch or eight-inch disks, \$29.

Illinois residents please add 5¼ percent sales tax. Visa and Master Card orders also accepted. Allow ten days for checks to clear.

Circle 323 on Reader Service card.

DISCOUNTS

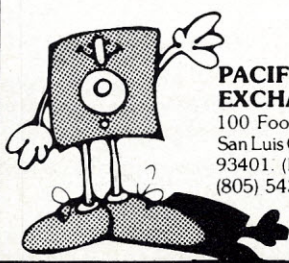
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8K buffer EIA RS-232C SERIAL interface	
-supports both X-ON/X-OFF & hardware handshaking	
-seven baud rates (300 to 19,200), DB25 connector	\$158
VENTEL MD-212 + 300/1200 baud (\$995 list)	\$872
MULTI-TECH MODEMS (FCC registered direct connect)	
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MT212A (BELL 212A compatible at either 1200 baud or 0-300 baud)	\$840
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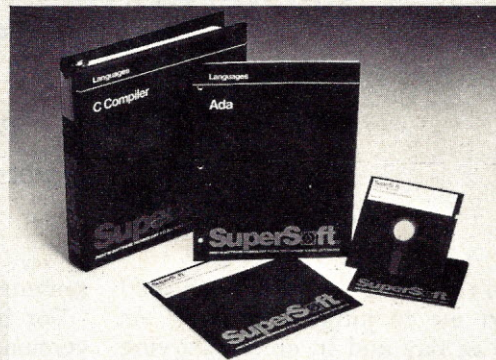
SuperSoft Ada is a native code, fully recursive, two pass compiler which generates ".COM" files. While currently a subset, SuperSoft Ada supports most features of the standard Ada language.

Required by the Department of Defense for Ada copyright protection: "This compiler is presently an incomplete implementation of the Ada programming language. It is intended that this compiler will be further developed to enable implementation of the complete Ada programming language, and then to be submitted to the Ada Joint Program Office for validation."

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Say It Again, Atari

You'll be amazed at what your Atari has to say, once you plug it into the Voice Box. This low-cost speech peripheral is also available for the Apple II.

By Jake Commander
Microcomputing Technical Editor

I can't believe it. My Atari 800 told me to jump in a river! As plain as day and in an unswerving tone, my previously well-behaved machine voiced the line I'd just entered. I typed: GO DJUHMP IN UH RIVUH; it said, "Go jump in a river." Amazing.

I consider myself fortunate indeed to have been able to review this preliminary version of the Voice Box (from the Alien Group, 27 W. 23rd St., New York, NY 10010), which is available for both Atari 400/800 and Apple II computers. There aren't too many of these goodies around yet, so I had my own private preview. I'm sad to see it go. It feels like saying goodbye to a friend. I never realized my Atari had so much to say. The possibilities are enormous.

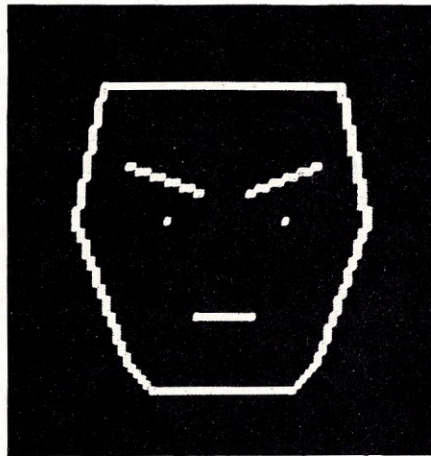
Who Just What?

On first encountering the unit, the temptation is too much to resist: from monosyllabic words up to long sentences, the Voice Box injects an endearing personality to your computer. With very little practice, the unit can grab your attention with a perfect utterance of the word "antidisestablishmentarianism," and then has you falling off your chair by politely asking, "Who just farted?" And worse.

For \$169 you get an actual black box (in the best computer tradition), nine pages of documentation and the driver software. The software comes on either disk or cassette and is available for computers with 16K or more of memory. The software is an important part of this package and takes up a fair amount of space—this necessitates the use of a stripped down version for 16K machines, which simply eliminates the random

sentence generator.

For this review, I used the Atari version, although I should stress that the Apple II version is just as good. For all intents and purposes it is the same unit except that it plugs into a spare slot and has a 100-word dictionary available



in an on-board read-only-memory (ROM) and speaks through an extension speaker. Price is \$199.

The Atari version, on the other hand, plugs into the serial I/O socket and speaks through the speaker in the TV display monitor. It's just a matter of plugging into the side of the keyboard or (as in my case) the serial socket at the rear of the disk drive.

The software supplied with the review unit came on disk. Typing "RUN D:VBRF" led me straight into some fun and games—and some interesting possibilities. VBRF is the software that contains the Voice Box driver, a random sentence generator and a talking face, which reminded

me of one of my teachers at school (except this one I could switch off).

Before diving into speech generation, the option of loading a dictionary for use by the program is offered. This allows for extreme flexibility and multiplies the usefulness of the unit tenfold. Let me explain.

Getting Rid of Foreign Accents

The Voice Box operates on phonemes rather than words. This means that words are built up from the individual phonetic sounds that make up each word. The alternative technology (as used in the Texas Instruments Speak 'n' Spell) is to have whole words pre-programmed into the vocalizer chip. This generally leads to more convincing synthesized speech but at the cost of versatility—only a limited vocabulary can be stored in such a chip.

However, because the Voice Box allows words to be built up from individual sounds, the vocabulary is virtually limitless. The only real limit to its range of words at any given time is the amount of memory available to store those words. This is where the all-important dictionary comes in.

Imagine the word "light." The "ight" portion causes the as-yet uneducated Voice Box to say "iggt" because it literally interprets the letters typed in. Being told to "switch on the liggt" just doesn't sound convincing.

So try the All-American *Chicago Tribune* version: "lite." Once again, the box responds with the literal pronunciation of "littee." So now you start to get the point: this thing has to be taught. Provided in the documentation is a list of all the consonant and vowel sounds that are available.

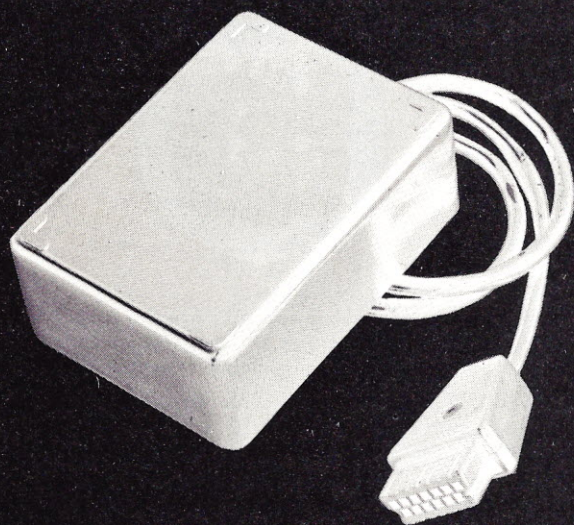
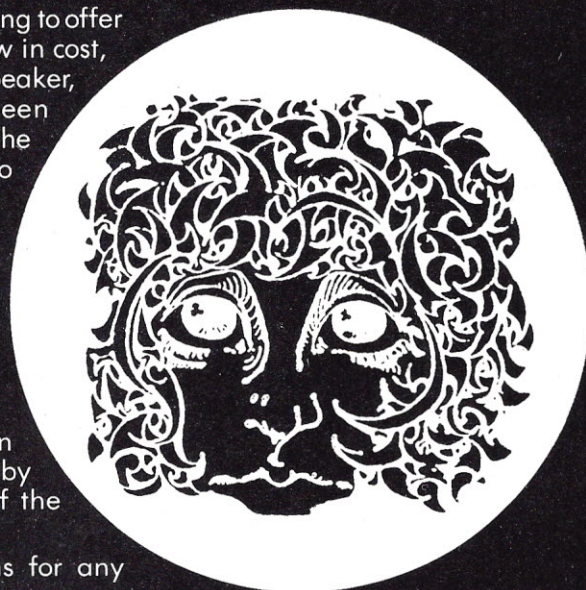
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- Insert cryptic spoken clues in maze games.

COMPUTER OPERATION

- Code verbal prompts and error messages that command attention and leave the current display intact.

EDUCATION

- Gain an introduction to the principles of phonetics.
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In addition, the *Random Sentence Generator* included in the operating system, which prints and speaks endlessly startling, amusing, even poetic combinations of words supplied by the user, helps teach school children to identify parts of speech and recognize a variety of sentence structures.

A minimum of 16K RAM is required by the operating system. Either disk or cassette includes both 16K and 32K versions. Try **VOICE BOX** for up to 10 days, and if it isn't the finest value you've ever seen in a computer peripheral, the most challenging and provocative addition you've ever made to your system, return it in its original condition for a full refund.

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It turns out that AH1 gives an "ah" sound as in "father," whereas Y gives an "i" sound as in "any." Thus, combining AH1 and Y gives a sound somewhat like the word "eye." Simple! Just put "L" at the start and "T" at the end so it looks like "LAH1YT"—this gives a sound like L-EYE-T, which is closer than LIGGT or LITTEE.

It would be a pain to type "LAH1YT" every time you wanted the word "light," so you just enter it into the dictionary by typing "LAH1YT=LIGHT." Thereafter, every time the word "light" is used, the word "LAH1YT" is pronounced. So it's just a matter of finding the closest-sounding rendition of the word required and then entering it into the dictionary.

Many such dictionaries can be built up and saved for subsequent use, allowing specialized versions for use in, say, a chemistry lab or a math class or even a computer room. (Yes, this thing will even speak in computer jargon.) Five dictionaries are supplied which already contain some of the more common phonetic sounds such as "ight," "ute" and so on.

Also supplied on the disk is a talking face. This is mainly for fun, although it could be incorporated into educational programs to add some interest for the younger audience (up to the age of about 90). After you type in the word you want pronounced, the lips move somewhat like an ill-trained ventriloquist. The rest of the face stares blankly at you in a semi-malevolent manner, just like my stone-faced physics teacher used to at school. This became too much for me and, after insulting the screen, I switched off for a later session.

Jabberwocky

The later session involved trying the final portion of the software—the random sentence generator. Once again, this is mainly for amusement, but it would certainly be an unusual way to pull some creative sentences out of thin air.

When I tried it, my Atari kept meandering on about Peter. Peter had apparently fallen in love with a ham sandwich which was sitting on a rabbit which hated the ham sandwich.

No matter how many times I tried

the random sentence, I kept hearing about Peter and his weird rabbit, ham sandwich and other sundry actors in this synthesized plot. As soon as Susan came onto the scene, I went back to the menu. I couldn't bear the thought of what the computer would have them do. No wonder the rabbit hated the ham sandwich. And what would Susan do with the rabbit? It certainly has Peyton Place beat.

In all seriousness, I don't think I'm stretching my accolade too far by stating that this is an excellent product. It you want to use it strictly as a voice output device, I don't know of a less expensive unit on the market.

By using the stripped-down program as the driver software, it is possible to incorporate this into all kinds of programs such as spelling or typing tutors. As a device to help blind people, the Voice Box is literally crying to be put to good use.

If you want some plain old good fun, this will have you splitting your sides. And next time some dullard confronts you and your computer with the old stanza about "what will it do?" let the computer tell him where to get off. ■

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The people who dared to teach Atari to talk are again challenging the microcomputer establishment with the VOICEBOX Speech Synthesizer for Apple. This low cost intelligent peripheral can speak thousands of words unassisted, generated directly from its firmware ROM dictionary located on its plug-in card. This means that speech, with variable intonation and speed, can be used in any of your apple programs without ever having to bother loading a disk. And, in case you want to expand your dictionary to include unusual words or words in foreign languages, you can easily define them with our 64 phonemes and store them by the thousands on one of the six special dictionaries provided for on our disk.

In addition your VOICEBOX for Apple can be easily coded to sing on key with uniform barlengths and you can store (record) your songs on disk, retrieving and modifying sections whenever you want. With the disk system, you'll also enjoy an educational random sentence generator and graphic speech animation! The VOICEBOX for Apple will run on 32K Apple II with Applesoft or Apple II Plus systems equipped with sixteen-sector disk drives. VOICEBOX for Apple comes with loudspeaker and disk. The Alien Group also makes a less expensive VOICEBOX for Apple with all features (including expandable disk dictionary), but excluding firmware ROM and singing capability. Speaker is optional on this unit.



For Atari users, the VOICEBOX for 16K and up Atari plugs directly into the serial port. No extra cables are

needed and no speaker is needed since the speech comes directly over your TV monitor. This unit has all speech synthesis features except singing and firmware ROM.

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A sampling of voice synthesis products for selected systems.

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PC-Mate Speech Master	Tecmar, Inc. 23600 Mercantile Road Cleveland, OH 44122 216-464-7410	IBM PC	\$395
V100 Interactive Voice Synthesizer	Vynet Corp. 2405 Qume Drive San Jose, CA 95131 408-942-1037	Apple II IBM PC	\$395
Speech 1000 Synthesizer Board	Telesensory Speech Systems 3408 Hillview Ave. PO Box 10099 Palo Alto, CA 94304 415-856-8255	Parallel I/O or serial I/O (RS-232C)	\$1200
Speech 1100 Downloadable Synthesizer Board	Telesensory Speech Systems	Parallel I/O or serial I/O (RS-232C)	\$1600
Prose 2000	Telesensory Speech Systems	RS-232C	\$3500 board \$4800 (PR2020 peripheral)
SP1020 Speech Peripheral	Telesensory Speech Systems	RS-232C	\$2500
Lisa Voice Synthesizer	Centigram Corp. 155A Moffett Park Drive Sunnyvale, CA 94086 408-734-3222	RS-232C	\$2450
Micromouth	Micromint Inc. 917 Midway Woodmere, NY 11598 800-646-3479	Apple II or any parallel port	\$120 (kit) \$150 (assembled)
Sweet Talker	Micromint Inc.	Apple II or any parallel port	\$141 (assembled parallel port board) \$151 (assembled Apple II board)
Supertalker SD200	Mountain Computer 3800 Harvey West Blvd. Santa Cruz, CA 95060 408-438-6650	Apple II	\$199
Type 'N Talk	Votrax 500 Stephenson Highway Troy, MI 48084 800-521-1350	RS-232C	\$375
Cognivox VIO-1003	Voicetek	Apple II	\$249
Cognivox VIO-1002	Dept. G, Box 388 Goleta, CA 93116	CBM	\$249
Voice Box	The Alien Group 27 West 23rd St. New York, NY 10010 212-924-5546	Atari 400, 800 Apple II	\$169 \$199
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Micros Are Sounding Good

With the strides taken in speech synthesis development in recent years, low-cost peripherals, such as the Votrax Type 'N Talk, are becoming an integral part of our lives.

By Jim Hansen

Speech synthesis has been with us since the 1930s when Bell Telephone showed that recognizable speech can be made from three components: a hum, a white noise ssss and a shhh sound. But not until the last few years has speech synthesis been available to the common man. And the first truly practical low-cost speech synthesizer arrived only last year.

A report in *Mini-Micro Systems* says that voice output equipment sales will rise from \$23 million this year to \$495 million by 1985. The possible applications are many. People with speech handicaps will find electronic speech essential for day-to-day living. So will those with severe cases of cerebral palsy, blindness, strokes, some forms of cancer and other crippling diseases. Low-cost speech synthesizers that enable these people to either talk or hear the written word

will find a large market. Talking stoves, refrigerators and thermometers, to name a few appliances, will help millions of people around the world.

Education also offers opportunities. Preschoolers can be taught and drilled with talking computers. Speech educators and therapists will be able to provide more and better service with inexpensive, high performance speech units. Psychologists can explore the speech recognition functions within the brain. Foreign languages can more readily be taught. Properly programmed, dialects within a language can even be replicated.

The home also has great potential for speech output products. I remember Bill Cosby, on a record, wanting a door bell that said "somebody is at the door" instead of going "bing-bong." Now, we are at the point where this kind of door bell is cheap enough to be practical.

On other fronts, I expect that talking microwave ovens and perhaps televisions and clocks will soon be the rage. (At least one talking clock is available now at about \$80; Radio Shack also sells one for \$59.)

Burglar alarms will be able to alert the appropriate people, perhaps even the burglar himself. Fire alarms in homes and businesses could give location and intensity information to the local fire department.

Cars will soon be talking. Datsun now has a tape in the 280Z, and Chrysler will be using a Texas Instruments TMS-1000 system for its 1983 models. I expect the government will want to nag you about your seat belts and driving habits. Plainly, there are hundreds of other places

where our tools and appliances will be more useful to us when they talk.

Two Types

Two general types of speech synthesis are available to us now. Texas Instruments (and other semiconductor houses) is championing stored speech synthesis. Examples of this are the Speak & Spell-like products that have come on the market during the last couple of years.

The details of this type of speech synthesis (linear predictive coding) are not terribly important; it involves digitizing an original voice and doing some very heavy-duty number crunching on it to reduce the amount of digital storage required. When the playback of the original voice is required, the digital data must first be reprocessed before it is sent to the loudspeaker. This operation requires the complete attention of a processor, usually buried inside the speech chip set.

The advantage of this technique is the high-quality output. The disadvantage is that it is an electronic version of a random access tape recorder—you can't get anything that isn't recorded. Furthermore, only factories can make the recording, which puts this type of synthesis out of the hands of the typical hobbyist.

The other technique is true synthesized speech. In this case a controller of some sort makes noises that, when properly ordered, are close enough to real speech that our brain

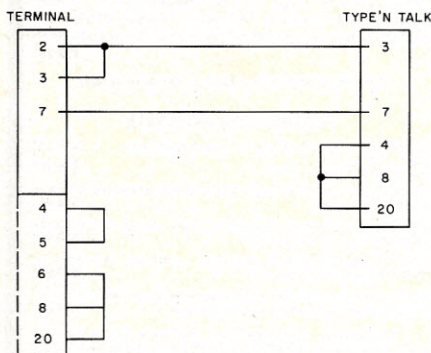


Fig. 1. Connecting the Type 'N Talk to a terminal. Most terminals will work with only pins 2, 3 and 7 connected. (The jumper from terminal pin 2 to pin 3 provides local copy. If your terminal has a half-duplex mode, select it and omit the pin 2-3 jumper.) Some other more intelligent terminals will require pins 4-5 and/or 6-8-20, shown in dotted box, to operate in local mode.

Address correspondence to Jim Hansen, PO Box 234, New Boston, NH 03070.

recognizes the product as speech.

The English language requires about 64 different noises, or phonemes, to make natural, good-sounding speech. These include such sounds and noises as ahhh, mmmm, nnnn, eeee and shhh. Actual words are made up by sequencing through a particular series of these word-building blocks, issuing the sounds for carefully controlled amounts of time before stepping to the next. Although it is not readily apparent, what is actually happening is that the human voice tract is being modeled. The listener to such a rudimentary system will have no trouble recognizing that the speech is mechanically generated, or at best that there is something seriously wrong with the speaker.

It is difficult to generate natural speech. Several problem areas can be easily identified. The transition from phoneme to phoneme in natural speech is complex and varies from person to person. This is why it sounds natural. In a machine we have to provide detailed information regarding exactly when and how to make these transitions. This takes more information per second of speech; further, it locks the speech into one particular pattern. Stored speech gets around this one by simply using a real voice. The rules governing phoneme transition change with the context of the speech.

Inflection is another problem. The robot-sounding monotone voice (not all that bad, as I will explain later) often heard in movies and on television is what results when no inflection is allowed in the speech pattern. Inflection is used for emphasis, to indicate the end of sentences, to reflect emotion and to imply meanings not possible with the words spoken. A host of other important details of spoken language are coded with various inflection patterns.

The only other problem I'll mention involves timing. The tempo of natural speech varies from the beginning to the end of a spoken sentence. The same word spoken within a sentence takes longer or shorter depending on emphasis, complex relationships in the sentence and the implied meaning. Furthermore, the same variances within the individual phonemes take place.

The lot of the synthesizer designer is to make acceptable trade-offs. There is and can be no fixed set of rules governing the management of all the phonemes, their timing and



Front view of the Votrax Type 'N Talk. The only two operator controls are the volume and frequency adjust knobs. The frequency control changes the pitch of the output speech from a very low, slow growl to a near soprano, quickly spoken voice.

their frequency (emphasis) in a manner that works all the time. Each phoneme must be treated individually in relation to those adjacent to it, and in relation to the words and their implied meanings surrounding the word being spoken and the position within the sentence; all the while you must take into account the overall meaning of the sentence.

It is possible, however, to make a voice synthesizer that sounds quite good. Very good ones, until the last few years, were expensive. Good ones now cost less than \$3500. The Votrax system B/2-2926 can produce quality unlimited speech in seven different languages. The user supplies the phonemes to be spoken and one of four levels of inflection, and out comes speech.

What's Available

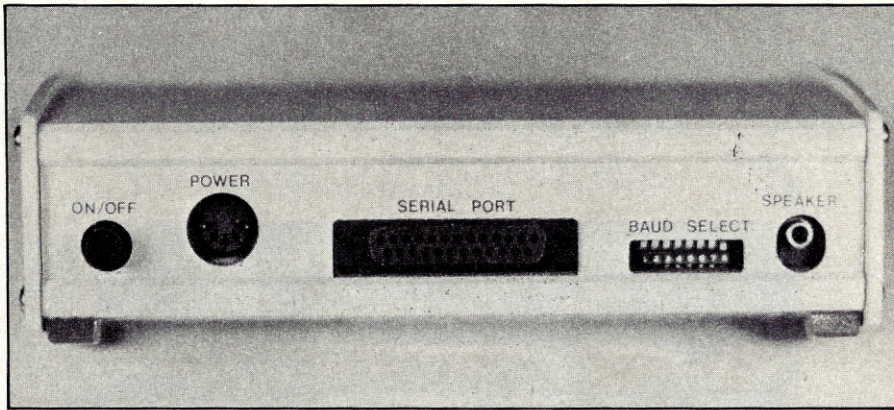
Let's look at a few of the synthesizers on the low end of the market. Two such synthesizers were available in 1976. Computalker is a single S-100 board product that requires extensive software to drive it. It was described in some detail in the August 1976 issue of *Byte*. (Those of you interested in speech synthesis would do well to read this particular issue of *Byte*, which was devoted almost entirely to speech.) I purchased a Computalker demonstration tape and found the speech quality understandable, but that was about it. The synthesizer did, however, cost less than \$500. Cybernetic Systems described their Model 1000 at \$425 in the same issue of *Byte*.

The next major development came from Texas Instruments when they brought out the Speak & Spell toy. The toy used a specially modified TMS-1000 microcomputer to unpack the speech contained in a large read-only memory. It was remarkable that the toy could produce such high-quality speech and yet retail for less than \$50. Several magazine articles have speculated on ripping the toy apart to drive it from a computer, but to my knowledge no one has yet published any results.

Telesensory Speech Systems now offers a word-oriented synthesizer module that can be driven from a parallel interface. It includes a 119-word basic vocabulary and runs from a single 5-V power supply. The vocabulary is selected so you can merge several words to make new ones. For instance, the word "in" and "put" can be spoken together as "input." The 4 by 4½-inch board and 119-word vocabulary ROM are priced at \$395. You can hear a Telesensory demonstration by calling 415-856-0225. They have several other speech products available for a variety of applications.

In 1980 Votrax Corp. introduced their SC-01 synthesizer chip, a 22-pin CMOS chip that produces phonemes on command from some higher intelligence. It also provides for several levels of inflection. The speech output from this chip is at least two orders of magnitude better than I heard on the Computalker demonstration tape.

The SC-01 chip is available by it-



Back apron of the Type 'N Talk. The speaker is connected to the internal 1-watt audio amplifier with a mini-jack. The desired baud rate is chosen by putting one of the eight baud-rate control switches to the down position. The power connector and on/off switch complete the back apron features.

```

10 REM SEND TYPED MESSAGE TO TYPE 'N TALK
11 REM CONNECTED TO SLOT 2
20 INPUT A$
25 IF A$ = "R" THEN 30
27 B$ = A$
30 PR# 2
40 PRINT B$
50 PR# 0
60 GOTO 20

```

Listing 1. This program gets a string [letters, words or sentences] from the keyboard in line 20. If the single letter R is input, the previous input is output again; otherwise line 30 selects output on slot 2, and sends the string to Type 'N Talk. This simple program clearly demonstrates how easy it is to use Type 'N Talk and provides a very simple way to learn how to use it initially, then later to perfect pronunciation.

self, in a product called Speech PAC (\$275), the VSM-1 Versatile Speech Module (\$995) and the Type 'N Talk (\$375). The Speech PAC is built on a 4 x 5½-inch printed circuit card, and contains a single EPROM socket for 2716 or 2532 EPROMs, the SC-01 chip, assorted control logic and an audio amplifier. It is powered from a 5-V and -12-V power supply and is interfaced via a parallel port on your computer.

The Speech PAC comes with a pre-programmed vocabulary of 250 words and two phrases, which may be intermixed with phonemes to generate unlimited speech. The type-written manual that comes with it (22 pages) provides clear instructions for connection to your computer, use of the several modes available, and a listing of all the prestored words and phrases with the phonemes for each. You also get a schematic diagram and instructions for using the 2532 (4K byte EPROM). (A 2716 2K byte EPROM is standard.)

I invite comparison of this product with the Sweet Talker, a kit de-

scribed in the Sept. 1981 issue of *Byte* ("Build an Unlimited Vocabulary Speech Synthesizer" by Steve Ciarcia). I would rate the Speech PAC as a best buy in voice synthesis at the very low end, because it is already assembled and guaranteed by an established company in the voice response business.

The Versatile Speech Module is actually a speech development system incognito. It includes the standard SC-01 chip, but also a 6800 microprocessor, both serial and parallel interface ports, several extra EPROM and RAM sockets for memory expansion, a 1300-word vocabulary and a voice operating system called voxOS.

This board can be used to produce sound effects, a fairly neglected aspect of the SC-01 chip, and good quality voice with encoded stress. The voxOS offers a host of features including phoneme editing, programming sequence memories for speech and sound effects patterns, a dozen "sound" macros for developing sound effects and more. This product will allow you to stretch the SC-01 to

the limits of its performance without causing you undue mental strain, but at nearly \$1000 will probably be more interesting to professionals than hobbyists.

State of the Art

The Type 'N Talk, however, is easily within the range of the serious computer hobbyist. Since it will speak ordinary English sentences "printed" to it, it is without a doubt going to make waves from one end of the speech synthesis spectrum to the other.

The Type 'N Talk is an example of state-of-the-art, low-cost nonstored speech synthesis. It is a compact unit, measuring about 7½ by 4½ by 3 inches, and is housed in a stout extruded aluminum case.

Operator controls on the front panel include a volume control and a frequency adjust controls that let you change the pitch and speed of the output "voice." The back apron provides a mini-jack for an 8-ohm loudspeaker or other audio system, a baud rate selector switch, a DB-25S socket for RS-232 input, the on-off switch and power connector. The power transformer is a TRS-80-like unit nearly half the size of the synthesizer, and plugs into it with a DIN-like connector. The cables can provide power up to nine feet from the wall socket.

The Type 'N Talk unit uses Votrax's SC-01 integrated circuit for speech synthesis. Although Votrax doesn't like to talk about the insides of the unit, I took a peek. It consists of a small PC board containing a 7805 voltage regulator and other power supply components, nine integrated circuits (including the SC-01 chip), a crystal for MPU operation and baud rate clock, a 1-W audio amplifier and a potted area on the board, probably containing a 6800-series microprocessor and maybe 4K bytes or so of EPROM. (This would be consistent with the versatile speech module.) The board is tightly packed and made of quality components.

Type 'N Talk uses an RS-232 interface for connection to terminals and computers. Available data transmission rates are 75, 150, 300, 600, 1200, 2400, 4800 and 9600. (I did all of my testing at 9600 baud.)

The internal buffer of 750 bytes is good for about a minute of speech, depending on the pitch-speed control setting. Handshaking using the request-to-send signal (pin 5 on the RS-232 connector) prevents data

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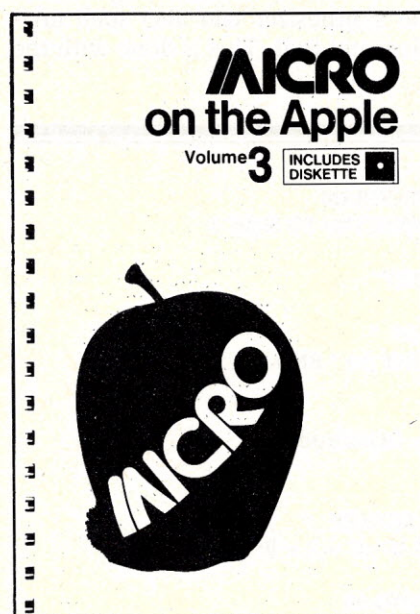
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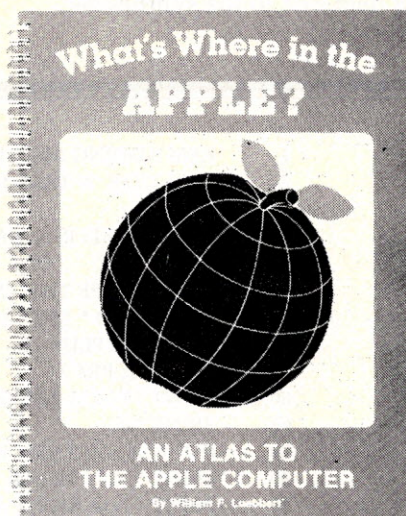
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overflow and resulting gibberish output. The XON and XOFF protocol used by many time-sharing systems is not available on Type 'N Talk, and so users of these systems will either need to hardwire them to use handshaking, or carefully manage the output data rate to the synthesizer.

Four software-selectable modes of operation are available. When turned on, Type 'N Talk automatically announces SYSTEM READY, and will "speak" any English text "printed" to it and ended with a carriage return. The synthesizer can also spell anything sent to it. This is done with the

Caps-on mode where any word with two or more leading capital letters is spelled rather than spoken. Another mode, PSend, causes Type 'N Talk to send back the phonemes it has generated from your text, rather than speak them.

The last operating mode is called Echo. Votrax has included the ability to selectively address up to eight Type 'N Talk units connected in a daisy chain. Each can selectively be addressed; data is sent from the host computer and echoed by each unit to the next one down the line. Only the addressed Type 'N Talk will respond to the text.

Two other commands are available. The Timer On command sets a four-second timer. In this mode any data sent to Type 'N Talk and not ended with a carriage return within four seconds will be spoken automatically. (This is useful when questions or prompts are provided but not ended with a carriage return.)

The Reset command is a software-initiated reset to all Type 'N Talks connected to the computer. It has the effect of re-initializing them to the same state as if power had just been applied.

All mode control commands are sent using the format

```
10 PRINT CHR$(27);CHR$(X)
```

where X is the decimal value of the desired control code. (CHR\$(27) is an ASCII escape code, and CHR\$(X) is a nonprintable control character.)

Type 'N Talk also responds to a backspace (control-H) by deleting the last character sent to it; a break will cause it to cancel all pending speech in the buffer.

Most users will probably find that Type 'N Talk can be used with normal text, but on occasion it may be necessary to revert to phonemes to get the best possible pronunciation. Phoneme data can be sent by preceding it with a tilde (~) and ending it with a question mark. Both

```
1 REM ADDING MACHINE PROGRAM
2 REM TYPE 'N TALK IS CONNECTED TO SLOT 2
10 PR# 2
20 PRINT "THIS IS A MATH TEST"
25 PRINT " "
30 PRINT "TYPE THE ANSER OF "
40 A = INT (10 * RND (1));B= INT (10 * RND (1))
45 PRINT A; "PLUS";B
50 INPUT C: PR# 2
60 PRINT "YOUR ANSER OF";: GOSUB 300
65 PRINT "IS";
80 IF C = A + B THEN 100
90 PRINT "NOT RIGHT, YOU TURKEY. ";
91 PRINT "THE RIGHT ANSER IS";:C = A + B: GOSUB 300
92 PRINT " . . . . .";: GOTO 30
100 PRINT "CORRECT . . . . .": GOTO 30
190 PRINT "TEN";
195 RETURN
200 PRINT "EELEVEN"
201 RETURN
205 PRINT "TWELVE";
206 RETURN
210 PRINT "THIRTEEN"
215 RETURN
220 PRINT " 4 TEEN";
225 RETURN
230 PRINT "FIF TEEN";
235 RETURN
240 PRINT "SIXTEEN";
245 RETURN
250 PRINT "SEVENTEEN";
255 RETURN
260 PRINT "EIGHTEEN";
265 RETURN
270 PRINT "NINE TEEN";
275 RETURN
300 IF C > 9 THEN 340
310 PRINT C;
320 RETURN
340 IF C > 19 THEN 370
341 C = C - 9
350 ON C GOSUB 190,200,205,210,220,230,240,250,260,270
356 C = C + 9
360 RETURN
370 C = 19: GOTO 341
```

Listing 2. This program demonstrates how simple mathematics quizzes can be set up using Type 'N Talk. Line 10 selects slot 2, the Type 'N Talk port. Line 20 causes it to speak an opening salutation, line 40 then generates two random numbers (integers in this case) between 0 and 9. Line 45 speaks the first number, the word "plus," then the last number. When an answer has been made, Type 'N Talk says "Your answer of," then input number, "is." Line 80 grades the answer. If it is correct Type 'N Talk continues with "correct," and the program loops for another question. If the response is incorrect, Type 'N Talk informs the player (line 90) and gives the correct answer in line 91. Notice the word "anser" in the listings is used to correctly pronounce "answer." Other programming oddities are shown in line 91 where a series of periods is sent to Type 'N Talk. These will cause a pause in the output speech. Type 'N Talk will speak any number sent to it, but those with two or more digits are spoken in terms of the single digit. For instance, 15 would be spoken as "one, five." The subroutine at line 300 takes care of this feature. Notice how 11, 14, 15 and 19 are coded for pronunciation.

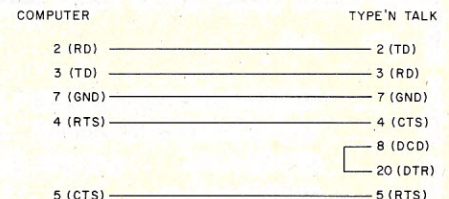
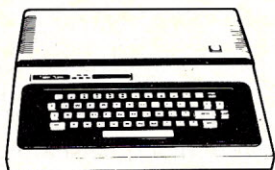
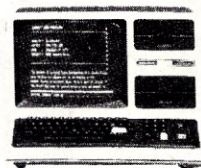


Fig. 2. Connections for a hardwired computer. Signal abbreviations are RD (receive data), TD (transmit data), GND (signal ground), RTS (request to send), CTS (clear to send) and DCD (data carrier detect).

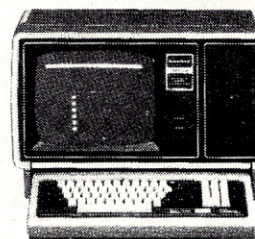
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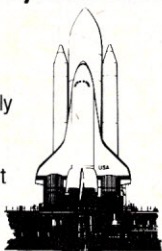
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```
10 AS = "ZYXWVUTS" REM Define String
20 SRT AS, LEN(AS), 1 REM Sort AS
```

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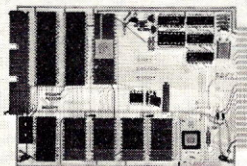
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Diane (an experienced computer user in the foreground) showing Jennifer (a first-time user) how the math quiz (see Listing 1) is to be played. Children new to computing tend to take things very seriously as Jennifer shows, but soon learn that the end of the world doesn't come if they do something wrong.

phonemes and normal text can be randomly intermixed.

The 32-page user's manual included with Type 'N Talk is exceptional in several respects. It is complete, nicely organized, well-written and easy to understand. Beginners will have no trouble understanding and using this product. Everyone will appreciate the organization, since all information relevant to a given topic is in one place.

The manual explains in simple English how to hook up Type 'N Talk, then how to control it. A full page is devoted to vocabulary development, correcting mispronounced words and how to use phonetic spelling.

Two appendices are provided. One gives examples showing how to deliberately misspell words so they are spoken correctly. (More on this later.) The other appendix provides a complete list of the phonemes avail-

able, including their duration times and sounds in example words.

Fig. 1 shows the connections required to make the Type 'N Talk work with an RS-232 interface and terminal. There are no tricks and Type 'N Talk works just like it was connected to a computer. (If you plan to use it with a time-sharing system, you may run into the problems mentioned earlier.)

The hookup to a hardwired computer is shown in Fig. 2. The pinouts are the "standard" RS-232C signals, but you'll probably find that the manufacturer of your computer has taken license to change signals around to "simplify" things for you, the user. Be sure to check your computer manual for correct pinouts!

Fig. 3 shows the wiring I used to connect Type 'N Talk to an Apple computer. I used a California Computer Systems asynchronous interface card because it is a complete interface, unlike Apple's high-speed serial interface that does not give status lines or I/O control signals.

Once you've properly connected Type 'N Talk to your computer, all you need to do is select the baud rate with the selector switch on the back of the unit and turn it on.

Type 'N Talk will accept regular English text and phonemes prepared by you. Type 'N Talk provides synthesis-by-rule, and so some words

```

1  REM SPELLING TEST
2  REM PROGRAM BOMBS WHEN WORD LIST IS
3  REM EXHAUSTED
4  REM TYPE 'N TALK IS CONNECTED TO SLOT 2
10 PR# 2
11 DATA BASEBALL,BASE BALL,COUNTRY, KUNTRY,MACHINE,MASHEEN
12 DATA ONLY,ONLY,ROLAIDS,RELEEF,BUGS BUNNY,BUGGS BUNNY,DOG,DOG,TRUE,TRU
13 DATA USER,USIR,TALKING,TALKING,BOOK,BOOK,STOVE,STOVE
14 DATA HEAT,HEAT,CHIMNEY,CHIMNEY,SMOKE,SMOKE,KITCHEN,KITCHEN
15 DATA LAMP,LAMP,DINNER,DINNER,BANANA,BANANA,APPLE,APPLE
16 DATA ROAD,RODE,CLOCK,CLOCK,CACTUS,KACTUS
20 PRINT "HELLO. THIS IS A SPELLING TEST"
30 PRINT "... HOW DO YOU SPELL"
40 READ A$,B$
45 PRINT B$
50 INPUT C$
60 IF C$ = A$ THEN 100
70 PR# 2: PRINT "WRONG. THE CORRECT ANSER IS"
80 PRINT CHR$ (27); CHR$ (21); A$
85 PRINT CHR$ (27); CHR$ (22)
90 PRINT "... "; GOTO 30
100 PR# 2: PRINT "CORRECT. ....": GOTO 30

```

Listing 3. The spelling test. This program simply reads a pair of strings from the data statements, speaking the second one, and testing for correct spelling using the first. For example, "base ball" is spoken, but the program expects "baseball" to be input for the answer. Notice the trick question "relief" (spelled "releef" for pronunciation) and the expected answer "Roloids." This simplistic program bombs when it runs out of data, but again demonstrates how easy it is to add voice to your computer and applications using Type 'N Talk.

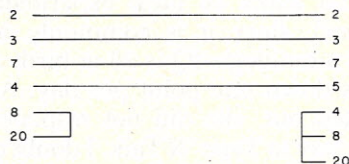


Fig. 3. Connecting Type 'N Talk to an Apple computer via a California Computer asynchronous interface.

will sound funny, or are totally mispronounced. In most cases this problem can be solved by simply misspelling the word. For instance, the word "baseball" actually sounds like "baziball." But if it is sent as "base ball" it sounds more like it should sound. Some other interesting words that must be misspelled to be spoken correctly are "error" ("airor"), "software" ("softwayr") and "shoes" ("shooz"). Of course, you could encode a list of phonemes instead, but misspelling words is much easier.

Listing 1 is an Apple program I used when I first got Type 'N Talk running. At home, I tried Type 'N Talk on both of my daughters—first and third graders—and on a random sampling of neighborhood children. My first program, Listing 2, was a simple mathematics quiz; two random numbers are generated and the computer asks for the sum. I had barely gotten the program running when I was booted off the system so the kids could play with it. The listing is just as I finished it before having to turn the program over to them, and so a certain amount of inelegance will be obvious to experienced Basic programmers. In spite of this, the program was a rousing success and ran for over five kid-hours the first time it was used (supper called an end to it). It dramatically demonstrates the ease with which speech using Type 'N Talk can be installed on your system.

Listing 3 is a quick-and-dirty spelling quiz. Since the synthesis-by-rule used by Type 'N Talk is guaranteed to mispronounce words, you must maintain two lists of words. One will contain the correct spelling of the target word; the other will be the spelling required to get the correct pronunciation out of Type 'N Talk. This program simply runs through the list and bombs when it is out of data. The reception for this program was not as enthusiastic as it was for the mathematics drill, but was nonetheless popular.

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Susan and Diane working on a spelling quiz. The voice quality of Type 'N Talk is good enough for spelling quizzes provided the instructor takes care in getting the best pronunciation possible and that the children have had a little time training their ears to understand Type 'N Talk.

I suggest that if you choose to use either of these two programs, you add the capability to repeat the question. I found that on many occasions the kids would be laughing (or kidding around, if you will) so much that the next question would be missed. This is particularly true of the spell-

ing quiz. A very popular feature seemed to be a computer insult to those unfortunate enough to make a mistake. A random assortment of dunnings and compliments will make the game even more enjoyable.

Becky Bulldog, our family mascot, was the target of a series of ex-

periments. I originally felt that she would make an ideal experimental animal, since it is commonly held that a bulldog's IQ is 25 at birth and goes down one point per day. As it turned out, she did not respond in any way to Type 'N Talk. I doubt that any other dog will pay more attention to Type 'N Talk than she unless you spend some time training the animal.

I'm very impressed with this product, but how does the Type 'N Talk sound, and is it worth the money?

Type 'N Talk sounds a lot like Robby the Robot with a slight amount of congestion. The voice is strictly monotone, and you have only the frequency knob to adjust the tempo of the speech. I found the voice easier to understand than the robots on TV's "Battlestar Galactica." This type of speech seems to be ideal for kid-computer relationships, but is certainly not natural. No attempt was made to allow the inflection logic or frequency controls of the SC-01 chip to be accessible by the user under program control.

An interesting perceptual phenomenon surrounds users of speech equipment such as this: the longer you listen to it, the easier it is to un-

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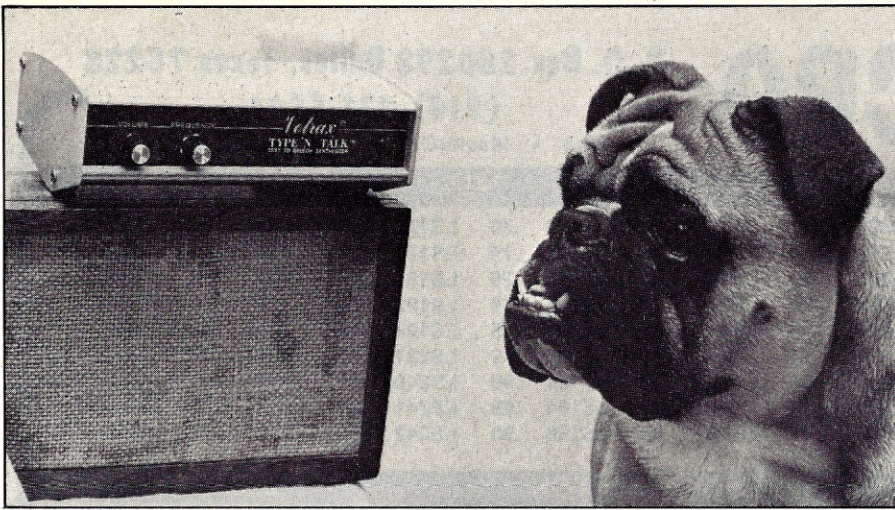
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derstand. Your "ear" is easily and quickly trained. One of the reasons is that the synthesizer speaks exactly the same way every time around. Before you know it, listening to Type 'N Talk is like listening to a friend from the Old Country.

Conclusions

I have to say that I've never had so

much enjoyment out of any computer peripheral (save a terminal) as with the Type 'N Talk. It's easily one that I cannot fault on technical or performance grounds. Votrax has made a quality product and if their 11-year history of speech product development means anything, we'll probably see more in the future. Votrax sometimes refers to Type 'N Talk as TNT,

and this isn't far off the mark—it's a dynamite piece of equipment. ■

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7610N	LM320K-5	1.35	CD4114	1.05	8420	1.95	10 type 05	1.95
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7616N	LM320K-5	1.35	CD4117	1.05	8426	1.95	10 type 05	1.95
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7636N	LM320K-5	1.35	CD4127	1.05	8446	1.95	10 type 05	1.95
7638N	LM320K-5	1.35	CD4128	1.05	8448	1.95	10 type 05	1.95
7640N	LM320K-5	1.35	CD4129	1.05	8450	1.95	10 type 05	1.95
7642N	LM320K-5	1.35	CD4130	1.05	8452	1.95	10 type 05	1.95
7644N	LM320K-5	1.35	CD4131	1.05	8454	1.95	10 type 05	1.95
7646N	LM320K-5	1.35	CD4132	1.05	8456	1.95	10 type 05	1.95
7648N	LM320K-5	1.35	CD4133	1.05	8458	1.95	10 type 05	1.95
7650N	LM320K-5	1.35	CD4134	1.05	8460	1.95	10 type 05	1.95
7652N	LM320K-5	1.35	CD4135	1.05	8462	1.95	10 type 05	1.95
7654N	LM320K-5	1.35	CD4136	1.05	8464	1.95	10 type 05	1.95
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7662N	LM320K-5	1.35	CD4140	1.05	8472	1.95	10 type 05	1.95
7664N	LM320K-5	1.35	CD4141	1.05	8474	1.95	10 type 05	1.95
7666N	LM320K-5	1.35	CD4142	1.05	8476	1.95	10 type 05	1.95
7668N	LM320K-5	1.35	CD4143	1.05	8478	1.95	10 type 05	1.95
7670N	LM320K-5	1.35	CD4144	1.05	8480	1.95	10 type 05	1.95
7672N	LM320K-5	1.35	CD4145	1.05	8482	1.95	10	

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5101	256 x 4	(cmos) (450ns)	4.95	3.95
2102-1	1024 x 1	(450ns)	.89	.85
2102L-2	1024 x 1	(LP) (250ns)	1.69	1.55
2102L-4	1024 x 1	(LP) (450ns)	1.29	1.15
2111	256 x 4	(450ns)	2.99	2.49
2112	256 x 4	(450ns)	2.99	2.79
2114	1024 x 4	(450ns)	8/16.95	1.95
2114L-2	1024 x 4	(LP) (200ns)	8/15.95	1.90
2114L-3	1024 x 4	(LP) (300ns)	8/18.95	2.25
2114L-4	1024 x 4	(LP) (450ns)	8/17.95	2.10
2147	4096 x 1	(55ns)	9.95	call
TMS4044-4	4096 x 1	(450ns)	3.49	3.25
TMS4044-3	4096 x 1	(300ns)	3.99	3.75
TMS4044-2	4096 x 1	(200ns)	4.49	4.25
MK4118	1024 x 8	(250ns)	9.95	call
TMM2016-200	2048 x 8	(200ns)	call	call
TMM2016-150	2048 x 8	(150ns)	call	call
HM6116-4	2048 x 8	(cmos) (200ns)	call	call
HM6116-3	2048 x 8	(cmos) (150ns)	call	call
HM6116-2	2048 x 8	(cmos) (120ns)	call	call
HM6116LP-4	2048 x 8	(LP)(cmos)(200ns)	call	call
HM6116LP-3	2048 x 8	(LP)(cmos)(150ns)	call	call
HM6116LP-2	2048 x 8	(LP)(cmos)(120ns)	call	call
Z-6132	4096 x 8	(Qstat)(300ns)	34.95	call

LP = Low Power

Qstat = Quasi-Static

DYNAMIC RAMS

			Each	100 pcs
TMS4027	4096 x 1	(250ns)	2.50	2.00
MK4108	8192 x 1	(200ns)	1.95	call
MM5298	8192 x 1	(250ns)	1.85	call
4116-120	16384 x 1	(120ns)	8/29.95	call
4116-150	16384 x 1	(150ns)	8/18.95	1.95
4116-200	16384 x 1	(200ns)	8/13.95	call
4116-250	16384 x 1	(250ns)	8/11.95	call
4116-300	16384 x 1	(300ns)	8/13.80	call
2118	16384 x 1	(5v) (150ns)	4.95	call
MK4816	2048 x 8	(5v) (300ns)	24.95	call
4164-200	65536 x 1	(5v) (200ns)	call	call
4164-150	65536 x 1	(5v) (150ns)	call	call

EPROMS

			Each	8 pcs
1702	256 x 8	(1us)	4.95	4.50
2708	1024 x 8	(450ns)	3.75	3.50
2758	1024 x 8	(5v) (450ns)	9.95	8.95
TMS2516	2048 x 8	(5v) (450ns)	6.95	5.95
2716	2048 x 8	(5v) (450ns)	4.95	3.95
2716-1	2048 x 8	(5v) (350ns)	9.00	8.50
TMS2716	2048 x 8	(450ns)	9.95	8.95
TMS2532	4096 x 8	(5v) (450ns)	9.95	7.95
2732	4096 x 8	(5v) (450ns)	9.95	7.95
2732A-2	4096 x 8	(5v) (200ns)	call	call
2764	8192 x 8	(5v) (450ns)	call	call
TMS2564	8192 x 8	(5v) (450ns)	call	call
MC68764	8192 x 8	(5v) (450ns) (24pin)	call	call

5v = Single 5 Volt Supply

EPROM ERASERS

	Capacity	Intensity	
Timer	Chip	(uW/Cm ²)	
PE-14	6	5,200	83.00
PE-14T	X 6	5,200	119.00
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Z-80
2.5 Mhz

Z80-CPU	3.95
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4.0 Mhz

Z80A-CPU	6.00
Z80A-CTC	8.65
Z80A-DART	18.75
Z80A-DMA	27.50
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Z80A-SIO/0	22.50
Z80A-SIO/1	22.50
Z80A-SIO/2	22.50
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6.0 Mhz

Z80B-CPU	17.95
Z80B-CTC	15.50
Z80B-PIO	15.50

ZILOG

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8200

8202	34.95
8205	3.50
8212	1.85
8214	3.85
8216	1.80
8224	2.50
8226	1.80
8228	4.90
8237	19.95
8238	4.95
8243	4.45
8250	14.95
8251	4.75
8253	9.25
8253-5	9.85
8255	4.75
8255-5	5.25
8257	8.50
8257-5	8.95
8259	6.90
8259-5	7.50
8272	39.95
8275	29.95
8279	9.50
8279-5	10.00
8282	6.65
8283	6.65
8284	5.70
8286	6.65
8287	6.50
8288	25.00
8289	49.95

8000

8035	7.25
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6800

68000	99.95
6800	4.95
6802	10.95
6808	13.90
6809E	19.95
6809	12.95
6810	2.95
6820	4.95
6821	4.95
6828	14.95
6840	12.95
6843	34.95
6844	25.95
6845	16.95
6847	12.25
6850	3.45
6852	5.75
6860	10.95
6862	11.95
6875	6.95
6880	2.95
6883	24.95
68047	24.95
68488	19.95

6800 = 1MHZ

68B00	10.95
68B02	22.25
68B09E	29.95
68B09	29.95
68B10	7.95
68B21	12.95
68B45	35.95
68B50	12.95

68B00 = 2 MHZ

6500

1 MHZ

6502	5.95
6504	6.95
6505	8.95
6507	9.95
6520	4.35
6522	8.75
6532	11.25
6545	22.50
6551	11.85

2 MHZ

6502A	9.95
6522A	11.70
6532A	12.40
6545A	28.50
6551A	12.95

3 MHZ

6502B	14.95
-------	-------

CRYSTALS

32.768 khz	1.95
1.0 mhz	4.95
1.8432	4.95
2.0	3.95
2.097152	3.95
2.4576	3.95
3.2768	3.95
3.579535	3.95
4.0	3.95
5.0	3.95
5.0688	3.95
5.185	3.95
5.7143	3.95
6.0	3.95
6.144	3.95
6.5536	3.95
8.0	3.95
10.0	3.95
14.31818	3.95
15.0	3.95
16.0	3.95
18.0	3.95
18.432	3.95
20.0	3.95
22.1184	3.95
32.0	3.95

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- ★ Friendly staff!
- ★ Fast service — most orders shipped within 24 hours!

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1791	29.95
1793	38.95
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.1uf DISC . . . 100/ 8.00	MC1350 . . . 1.19
.1uf MONO . . . 100/15.00	MC1358 . . . 1.39
	LM1800 . . . 1.99

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2716

16K EPROMS

8/\$3⁹⁵

EACH

2732

32K EPROMS

8/\$7⁹⁵

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74LS00

74LS00	.25	74LS85	1.15	74LS168	1.75	74LS295	1.05
74LS01	.25	74LS86	.40	74LS169	1.75	74LS298	1.20
74LS02	.25	74LS90	.65	74LS170	1.75	74LS324	1.75
74LS03	.25	74LS91	.89	74LS173	.80	74LS352	1.55
74LS04	.25	74LS92	.70	74LS174	.95	74LS353	1.55
74LS05	.25	74LS93	.65	74LS175	.95	74LS363	1.35
74LS08	.35	74LS95	.85	74LS181	2.15	74LS364	1.95
74LS09	.35	74LS96	.95	74LS189	9.95	74LS365	.95
74LS10	.25	74LS107	.40	74LS190	1.00	74LS366	.95
74LS11	.35	74LS109	.40	74LS191	1.00	74LS367	.70
74LS12	.35	74LS112	.45	74LS192	.85	74LS368	.70
74LS13	.45	74LS113	.45	74LS193	.95	74LS373	1.75
74LS14	1.00	74LS114	.50	74LS194	1.00	74LS374	1.75
74LS15	.35	74LS122	.45	74LS195	.95	74LS377	1.45
74LS20	.25	74LS123	.95	74LS196	.85	74LS378	1.18
74LS21	.35	74LS124	2.99	74LS197	.85	74LS379	1.35
74LS22	.25	74LS125	.95	74LS221	1.20	74LS385	1.90
74LS26	.35	74LS126	.85	74LS240	1.29	74LS386	.65
74LS27	.35	74LS132	.75	74LS241	1.29	74LS390	1.90
74LS28	.35	74LS136	.55	74LS242	1.85	74LS393	1.90
74LS30	.25	74LS137	.99	74LS243	1.85	74LS395	1.65
74LS32	.35	74LS138	.75	74LS244	1.29	74LS399	1.70
74LS33	.55	74LS139	.75	74LS245	1.90	74LS424	2.95
74LS37	.55	74LS145	1.20	74LS247	.75	74LS447	.37
74LS38	.35	74LS147	2.49	74LS248	1.25	74LS490	1.95
74LS40	.35	74LS148	1.35	74LS249	.99	74LS624	3.99
74LS42	.55	74LS151	.75	74LS251	1.30	74LS668	1.69
74LS47	.75	74LS153	.75	74LS253	.85	74LS669	1.89
74LS48	.75	74LS154	2.35	74LS257	.85	74LS670	2.20
74LS49	.75	74LS155	1.15	74LS258	.85	74LS674	9.65
74LS51	.25	74LS156	.95	74LS259	2.85	74LS682	3.20
74LS54	.35	74LS157	.75	74LS260	.65	74LS683	2.30
74LS55	.35	74LS158	.75	74LS266	.55	74LS684	2.40
74LS63	1.25	74LS160	.90	74LS273	1.65	74LS685	2.40
74LS73	.40	74LS161	.95	74LS275	3.35	74LS688	2.40
74LS74	.45	74LS162	.95	74LS279	.55	74LS689	2.40
74LS75	.50	74LS163	.95	74LS280	1.98	74LS783	24.95
74LS76	.40	74LS164	.95	74LS283	1.00	81LS95	1.69
74LS78	.50	74LS165	.95	74LS290	1.25	81LS96	1.69
74LS83	.75	74LS166	2.40	74LS293	1.85	81LS97	1.69
						81LS98	1.69

74S00

74S00	.44	74S85	2.39	74S169	5.44	74S274	19.95
74S02	.48	74S86	1.44	74S174	1.09	74S275	19.95
74S03	.48	74S112	1.59	74S175	1.09	74S280	2.90
74S04	.79	74S113	1.98	74S181	4.47	74S287	4.75
74S05	.79	74S114	1.50	74S182	2.95	74S288	4.45
74S08	.48	74S124	2.77	74S188	3.95	74S289	6.98
74S09	.98	74S132	1.24	74S189	14.95	74S301	6.95
74S10	.69	74S133	.98	74S194	2.95	74S373	3.45
74S11	.88	74S134	.69	74S195	1.89	74S374	3.45
74S15	.70	74S135	1.48	74S196	4.90	74S381	7.95
74S20	.68	74S138	1.08	74S197	4.25	74S387	5.75
74S22	.98	74S139	1.25	74S201	14.95	74S412	2.98
74S30	.48	74S140	1.45	74S225	8.95	74S471	9.95
74S32	.98	74S151	1.19	74S240	3.98	74S472	16.85
74S37	1.87	74S153	1.19	74S241	3.75	74S474	17.85
74S38	1.68	74S157	1.19	74S244	3.98	74S482	15.60
74S40	.44	74S158	1.45	74S251	1.90	74S470	7.80
74S51	.78	74S161	2.85	74S253	7.45	74S571	7.80
74S64	.79	74S162	3.70	74S257	1.39		
74S65	1.25	74S163	3.75	74S258	1.49		
74S74	.69	74S168	4.65	74S260	1.83		

LED DISPLAYS

HP 5082-7760	.6"	CC	1.29
MAN 72	.3"	CA	.99
MAN 74	.3"	CC	.99
FND-357 (359)	.375"	CC	.75
FND-500 (503)	.5"	CC	.99
FND-507 (510)	.5"	CA	.99

LED LAMPS

	1-99	100-up
Jumbo Red	.10	.09
Jumbo Green	.18	.15
Jumbo Yellow	.18	.15

IC SOCKETS

	1-99	100
8 pin ST	.13	.11
14 pin ST	.15	.12
16 pin ST	.17	.13
18 pin ST	.20	.18
20 pin ST	.29	.27
22 pin ST	.30	.27
24 pin ST	.30	.27
28 pin ST	.40	.32
40 pin ST	.49	.39

ST - SOLDERTAIL

8 pin WW	.59	.49
14 pin WW	.69	.52
16 pin WW	.69	.58
18 pin WW	.99	.90
20 pin WW	1.09	.98
22 pin WW	1.39	1.28
24 pin WW	1.49	1.35
28 pin WW	1.69	1.49
40 pin WW	1.99	1.80

WW - WIREWRAP

16 pin ZIF	6.75	call
24 pin ZIF	9.95	call

ZIF - TEXTOL

(Zero Insertion Force)

CONNECTORS

RS232 MALE	3.25
RS232 FEMALE	3.75
RS232 FEMALE	
RIGHT ANGLE	5.25
RS232 HOOD	1.25
S-100 ST	3.95
S-100 WW	4.95

DIP SWITCHES

4 POSITION	.85
5 POSITION	.90
6 POSITION	.90
7 POSITION	.95
8 POSITION	.95

9000 SERIES

9316	1.00
9334	2.50
9368	3.95
9401	9.95
9601	.75
9602	1.50
96S02	1.95

DATA ACQUISITION

ADC0800	15.55
ADC0804	4.95
ADC0809	5.25
ADC0817	10.95
DAC0800	4.95
DAC0808	4.95
DAC1020	8.25
DAC1022	8.25
MC1408L8	4.95

INTERSIL

ICL7103	9.50
ICL7106	9.95
ICL7107	12.95
ICL8038	3.95
ICM7107A	5.59
ICM7208	15.95

7400

7400	.19	74136	.50
7401	.19	74141	.65
7402	.19	74142	2.95
7403	.19	74143	2.95
7404	.19	74145	.60
7405	.25	74147	1.75
7406	.29	74148	1.20
7407	.29	74150	1.35
7408	.24	74151	.65
7409	.19	74152	.65
7410	.19	74153	.55
7411	.25	74154	1.40
7412	.30	74155	.75
7413	.35	74156	.65
7414	.55	74157	.55
7416	.25	74159	1.65
7417	.25	74160	.85
7420	.19	74161	.70
7421	.35	74162	.85
7422	.29	74163	.85
7423	.29	74164	.85
7425	.29	74165	.85
7426	.29	74166	1.00
7427	.29	74167	2.95
7428	.45	74170	1.65
7430	.19	74172	5.95
7432	.29	74173	.75
7433	.45	74174	.89
7437	.29	74175	.89
7438	.29	74176	.89
7440	.19	74177	.75
7442	.49	74178	1.15
7443	.65	74179	1.75
7444	.69	74180	.75
7445	.69	74181	2.25
7446	.59	74182	.75
7447	.69	74184	2.00
7448	.69	74185	2.00
7450	.19	74132	.45
7451	.23	74190	1.15
7453	.23	74191	1.15
7454	.23	74192	.79
7460	.23	74193	.79
7470	.35	74194	.85
7472	.29	74195	.85
7473	.34	74196	.79
7474	.35	74197	.75
7475	.49	74198	1.35
7476	.35	74199	1.35
7480	.59	74221	1.35
7481	1.10	74246	1.35
7482	.95	74247	1.25
7483	.50	74248	1.85
7485	.65	74249	1.95
7486	.35	74251	.75
7489	4.95	74259	2.25
7490	.35	74265	1.35
7491	.40	74273	1.95
7492	.50	74276	1.25
7493	.49	74279	.75
7494	.65	74283	2.00
7495	.55	74284	3.75
7496	.70	74285	3.75
7497	2.75	74290	.95
74100	1.00	74293	.75
74107	.30	74298	.85
74109	.45	74351	2.25
74110	.45	74365	.65
74111	.55	74366	.65
74116	1.55	74367	.65
74120	1.20	74368	.65
74121	.29	74376	2.20
74122	.45	74390	1.75
74123	.55	74393	1.35
74125	.45	74425	3.15
74126	.45	74426	.85
74128	.55	74490	2.55

CMOS

4000	.35	4528	1.25
4001	.35	4531	.95
4002	.25	4532	1.95
4006	.95	4538	1.95
4007	.29	4539	1.95
4008	.95	4543	2.70
4009	.45	4555	.95
4010	.45	4556	.95
4011	.35	4581	1.95
4012	.25	4582	1.95
4013	.45	4584	.95
4014	.95	4585	.95
4015	.95	4702	12.95
4016	.45	74C00	.35
4017	1.15	74C02	.35
4018	.95	74C04	.35
4019	.45	74C08	.35
4020	.95	74C10	.35
4021	.95	74C14	1.50
4022	1.15	74C20	.35
4023	.35	74C30	.35
4024	.75	74C32	.50
4025	.35	74C42	1.75
4026	1.65	74C48	1.20
4027	.65	74C73	.65
4028	.80	74C74	.85
4029	.95	74C76	.80
4030	.45	74C83	1.95
4034	2.95	74C85	1.95
4035	.85	74C86	.95
4040	.95	74C89	4.50
4041	1.25	74C90	1.75
4042	.75	74C93	1.75
4043	.85	74C95	1.75
4044	.85	74C107	1.50
4046	.95	74C150	5.75
4047	.95	74C151	2.25
4049	.55	74C154	3.25
4050	.55	74C157	1.75
4051	.95	74C160	2.00
4053	.95	74C161	2.00
4060	1.45	74C162	2.00
4066	.75	74C163	2.00
4068	.40	74C164	2.00
4069	.35	74C165	2.00
4070	.30	74C173	2.00
4071	.30	74C174	2.25
4072	.30	74C175	2.25
4073	.30	74C192	2.25
4075	.30	74C193	2.25
4076	.95	74C195	2.25
4078	.30	74C200	5.75
4081	.30	74C221	2.25
4082	.30	74C373	2.75
4085	.95	74C374	2.75
4086	.95	74C901	.80
4093	.95	74C902	.85
4098	2.49	74C903	.85
4099	1.95	74C905	10.95
14409	12.95	74C906	.95
14410	12.95	74C907	1.00
14411	11.95	74C908	2.00
14412	12.95	74C909	2.75
14419	4.95	74C910	9.95
4502	.95	74C911	10.00
4503	.65	74C912	10.00
4508	1.95	74C914	1.95
4510	.95	74C915	2.00
4511	.95	74C918	2.75
4512	.95	74C920	17.95
4514	1.25	74C921	15.95
4515	2.25	74C922	5.59
4516	1.55	74C923	5.95
4518	1.25	74C925	6.75
4519	1.25	74C926	7.95
4520	1.25	74C927	7.95
4522	1.25	74C928	7.95
4526	1.25	74C929	19.95
4527	1.95	74C930	19.95

4116 16K DYNAMIC RAMS 250 NS 8/\$11⁹⁵ SET

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LM301	.34	LM350K	5.60	NE570	4.75
LM301H	.79	LM350T	4.60	NE571	3.95
LM307	.45	LM358	.98	NE592	2.75
LM308	.98	LM359	1.79	LM703	.89
LM308H	1.15	LM376	3.75	LM709	.59
LM309H	1.95	LM377	2.29	LM710	.75
LM309K	1.49	LM378	2.50	LM711	.79
LM310	1.75	LM379	4.50	LM723	.49
LM311	.64	LM380	1.29	LM723H	.55
LM311H	.89	LM380N-8	1.10	LM733	.98
LM312H	1.75	LM381	1.60	LM741N-8	.35
LM317K	3.95	LM382	1.60	LM741N-14	.35
LM317T	1.95	LM383	1.95	LM741H	.40
LM318	1.49	LM384	1.95	LM747	.79
LM318H	1.59	LM386	1.50	LM748	.59
LM319H	1.25	LM387	1.40	LM1014	2.75
LM319	1.25	LM389	1.35	LM1303	1.95
LM320 (see 7900)		LM390	1.95	LM1304	1.19
LM322	1.65	LM392	.69	LM1305	1.49
LM323K	4.95	LM394H	3.60	LM1307	.85
LM324	.59	LM399H	5.00	LM1310	2.90
LM329	.69	NE531	3.75	MC1330	1.89
LM331	3.95	NE536	6.00	MC1349	1.89
LM334	1.30	NE555	.39	MC1350	1.29
LM335	1.40	NE556	.69	MC1358	1.79
LM336	1.75	NE558	1.50	LM1414	1.59
LM337K	3.95	NE561	19.95	LM1458	.69
LM337T	2.95	NE562	6.00	LM1488	.99
LM338K	6.95	NE564	3.95	LM1489	.99
LM339	.99	LM565	.99	LM1496	.85
LM340 (see 7800)		LM566	1.49	LM1558H	3.10
LM348	1.20	LM567	1.29		

H = TO-5 CAN

BI FET EXAR

LM1800	2.99	TL071	.79	XR 2206	3.75
LM1812	8.25	TL072	1.19	XR 2207	3.85
LM1815	5.20	TL074	2.19	XR 2208	3.90
LM1818	2.90	TL081	.79	XR 2211	5.25
LM1820	3.50	TL082	1.19	XR 2240	3.25
LM1830	3.50	TL083	1.19		
LM1871	5.49	TL084	2.19		
LM1872	5.49	LF347	2.19		
LM1877	3.25	LF351	.60		
LM1889	2.49	LF353	1.00		
LM1896	1.75	LF355	1.10		
LM2877	2.05	LF356	1.10		
LM2878	2.25	LF357	1.40		
LM2900	.85				
LM2901	1.00				
LM3900	.59				

RCA

CA 3010	.99
CA 3013	2.00
CA 3023	2.75
CA 3035	2.49
CA 3039	1.29
CA 3046	1.25
CA 3053	1.45
CA 3059	2.90
CA 3060	2.90
CA 3065	1.75
CA 3080	1.10
CA 3081	1.65
CA 3082	1.65
CA 3083	1.55
CA 3086	.80
CA 3089	2.99
CA 3096	3.49
CA 3130	1.30
CA 3140	1.15
CA 3146	1.85
CA 3160	1.19
CA 3401	.59
CA 3600	3.45

TI

TL494	4.20
TL496	1.65
TL497	3.25
75107	1.49
75188	1.25
75189	1.25
75450	.59
75451	.39
75452	.39
75453	.39
75454	.39
75491	.79
75492	.79
75493	.89
75494	.89

T = TO-220

K = TO-3

VOLTAGE REGULATORS

7805T	.89	7905T	.99
7808T	.89	7908T	.99
7812T	.89	7912T	.99
7815T	.89	7915T	.99
7824T	.89	7924T	.99
7805K	1.39	7905K	1.49
7812K	1.39	7912K	1.49
7815K	1.39	7915K	1.49
7824K	1.39	7924K	1.49
78L05	.69	79L05	.79
78L12	.69	79L12	.79
78L15	.69	79L15	.79
78H05K	9.95	LM323K	4.95
78H12K	9.95	UA78S40	1.95

T = TO-220

K = TO-3

L = TO-92

TRANSISTORS DIODES

PN2222	TO-92	10/1.00	100/8.99
PN2907	TO-92	10/1.25	100/10.99
2N2222	TO-18	.25	50/10.99
2N2907	TO-18	.25	50/10.99
2N3055	TO-3	.79	10/6.99
3055T	TO-220	.69	10/5.99
2N3904	TO-92	10/1.00	100/8.99
2N3906	TO-92	10/1.00	100/8.99
1N4148 (1N914)		25/1.00	1000/35.00
1N4004		10/1.00	100/8.99

AUGUST CPU SALE

8 BIT

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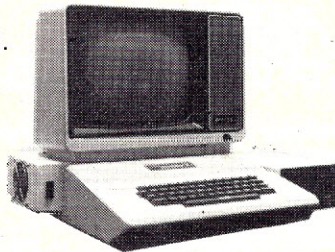
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High resolution 18 MHz compact video monitors.

VDM-751210	12" Amber phosphor	\$149.95
VDM-751220	12" Green phosphor	\$139.95
VDM-750910	9" Amber phosphor	\$149.95
VDM-750920	9" Green phosphor	\$139.95

Modems

SIGNALMAN - Anchor

Direct-connect automatic answer/originate selection, 300 Baud full duplex, Bell 103, includes RS-232 cable
IOM-5600A Signalman \$98.50

SMARTMODEM - Hayes

Sophisticated direct-connect auto-answer/auto-dial modem, touch-tone or pulse dialing, RS-232C interface, programmable

IOM-5400A	Smartmodem	\$248.95
IOM-1500A	Hayes Chronograph	\$218.95
IOM-2010A	Micromodem II	\$328.95
IOM-1100A	Micromodem 100	\$368.95

EPROM Erasers

ULTRA-VIOLET EPROM ERASERS

Inexpensive erasers for industry or home.

XME-3100A	Spectronics w/o timer	\$69.50
XME-3101A	Spectronics with timer	\$94.50
XME-3200A	Economy model	\$39.95

Single User System

THREE BOARD SET - SD Systems

4 MHz Z-80A CPU, 64K RAM (optional 256K), serial I/O port, parallel I/O port, double density disk controller, CP/M 2.2 & manual set, system monitor, control & diagnostic software. Includes SBC-200, 64K ExpandoRAM II, Versafloppy II, & CP/M 2.2 - all boards are assembled & tested.
Board set with 64K of RAM \$1095.00
Board set with 256K of RAM \$1295.00

Apple II Accessories

16K RAM CARD - for Apple II

Expand your Apple to 64K, 1 year warranty

MEX-16700A Save \$125.00 !!! \$69.95

ADD-ON DISK DRIVE - for Apple II

Inexpensive direct replacement for Apple Disk II, works with Apple II controller as first or second drive.

MSM-123200	Add On Drive	\$319.95
MSM-123100	Controller	\$94.95

Z-80 CPU CARD - for Apple II

Two computers in one, Z-80 & 6502, more than doubles the power and potential of your Apple, includes Z-80 CPU card CP/M and complete manual set.

CPX-62800A A & T with software \$249.95

8" DISK CONTROLLER - Vista

New from Vista Computer, single or double sided, single or double density, compatible with DOS 3.2/3.3, Pascal, & CP/M 2.2, Shugart & Qume compatible

IOD-2700A A & T \$499.95

2 MEGABYTES for Apple II

Complete package includes: Two 8" double-density disk drives, Vista double-density 8" disk controller, cabinet, power supply, & cables, DOS 3.2/3.3, CP/M 2.2, & Pascal compatible.

1 MegaByte Package Kit	\$1495.00
1 MegaByte Package A & T	\$1695.00
2 MegaByte Package Kit	\$1795.00
2 MegaByte Package A & T	\$1995.95

APPLE-CAT - Novation

Software selectable 1200 or 300 baud, direct connect, auto-answer/auto-dial, auxiliary 3-wire RS232C serial port for printer.

IOM-5232A Save \$50.00!!!! \$325.95

VISION 80 - Vista Computer

80 column x 24 line video card for Apple II, 128 ASCII characters, upper and lower case, 9 x 10 dot matrix with 3 dot descenders, standard data media terminal control codes, CP/M Pascal & Fortran compatible, 50/60 Hz

IOV-2400A Vista Vision 80 \$299.95

CPS MULTICARD - Mtn. Computer

Three cards in one! Real time clock/calendar, serial interface, & parallel interface - all on one card.

IOX-2300A A & T \$179.95

HI-RES GRAPHICS CARD - Genie

Intelligent printer interface and control card allows full high resolution graphics and screen dumps.

IOP-2405A	Genie for Epson	\$119.95
IOP-2410A	Genie for Okidata	\$119.95
IOP-2415A	Genie for NEC/C. Itoh	\$119.95

Power Strips

ISOBAR - GSC

Isolates & protects your valuable equipment from high voltage spikes & AC line noise, inductive isolated ground, 15 amp circuit breaker, U.L. listed

EME-115103	3 socket	\$39.50
EME-115105	4 socket	\$49.50
EME-115100	8 socket	\$54.50
EME-115110	9 socket rackmount	\$74.50

Single Board Computer

SUPERQUAD - Adv. Micro Digital

Single board, standard size S-100 computer system, 4 MHz Z-80A, single or double density disk controller for 5 1/4" or 8" drives, 64K RAM, extended addressing, up to 4K of EPROM, 2 serial & 2 parallel I/O ports, real time interrupt clock, CP/M compatible.

CPC-30800A	A & T	\$724.95
IOX-4232A	Serial I/O adapter	\$29.95

Z-80 STARTER KIT - SD Systems

Complete Z-80 microcomputer with RAM, ROM, I/O, keyboard, display, kludge area, manual, & workbook.

CPS-30100K	Kit with workbook	\$299.95
CPS-30100A	A & T with workbook	\$469.95

AIM-65 - Rockwell International

Complete 6502 microcomputer with alphanumeric display, printer, keyboard, & instruction manual.

CPK-50165A	1K AIM-65	\$424.95
CPK-50465A	4K AIM-65	\$474.95
SFK-74600008E	8K Basic ROM	\$64.95
SFK-64600004E	4K assembler ROM	\$43.95
SFK-74600020E	PL/65 ROM	\$84.95
SFK-74600010E	Forth ROM	\$64.95
SFK-74600030E	Instant Pascal	\$99.95
PSX-030A	Power supply	\$64.95
ENX-000002	Enclosure	\$54.95

SPECIAL PACKAGE

4K AIM-65, 8K Basic, power supply, & enclosure

Special Package Price \$649.95

S-100 EPROM Boards

PROM-100 - SD Systems

2708, 2716, 2732 EPROM programmer with software.

MEM-99520K	Kit with software	\$189.95
MEM-99520A	A & T with software	\$249.95

PB-1 - SSM Microcomputer

2708, 2716 EPROM board with on-board programmer.

MEM-99510K	Kit with manual	\$154.95
MEM-99510A	A & T with manual	\$219.95

EPROM BOARD - Jade

16K or 32K uses 2708 or 2716 EPROMs, 1K boundary.

MEM-16230K	Kit w/o EPROMs	\$79.95
MEM-16230A	A & T w/o EPROMs	\$119.95

S-100 Video Boards

SPECTRUM COLOR - CompuPro

Full-function color graphics board, up to 8 colors, 256 x 192 graphics, parallel I/O port, 8K RAM.

IOV-1870A	A & T	\$348.95
IOV-1870C	CSC	\$398.95

MICROANGELO - Scion

Ultra-high-resolution 512 x 480, 256 color or black & white S-100 video board

IOV-1500A A & T \$999.95

S-100 MotherBoards

ISO-BUS - Jade

Silent, simple, and on sale - a better motherboard

6 Slot (5 1/4" x 8 1/2")		
MBS-061B	Bare board	\$19.95
MBS-061K	Kit	\$39.95
MBS-061A	A & T	\$59.95

12 Slot (9 1/4" x 8 1/2")		
MBS-121B	Bare board	\$29.95
MBS-121K	Kit	\$69.95
MBS-121A	A & T	\$99.95

18 Slot (14 1/2" x 8 1/2")		
MBS-181B	Bare board	\$49.95
MBS-181K	Kit	\$99.95
MBS-181A	A & T	\$139.95

ACTIVE TERMINATOR - CompuPro

A true mother's helper.

TSX-100A A & T \$59.45

Prices may be slightly higher at our retail locations. Please call the store nearest you for local price and availability.

CompuPro Boards on Sale

S-100 CPU Boards

8086/8087 - CompuPro

16 bit, 8 or 10 MHz 8086 CPU with provisions for 8087 & 80130.

CPU-70520A 8 MHz 8086 A & T	\$624.95
CPU-70520C 8 MHz 8086 CSC	\$764.95
CPU-70530A with 8087 A & T	\$1224.95
CPU-70530C with 8087 CSC	\$1455.95

8085/8086 - CompuPro

Both 8 & 16 bit CPUs, standard 8 bit S-100 bus, up to 8 MHz, accesses 16 Megabytes of memory.

CPU-20510A 6 MHz A & T	\$398.95
CPU-20510C 6/8 MHz CSC	\$497.95

CPU-Z - CompuPro

2/4 MHz Z80A CPU, 24 bit addressing.

CPU-30500A 2/4 MHz A & T	\$279.95
CPU-30500C 3/6 MHz CSC	\$374.95

SBC-200 - SD Systems

4 MHz Z-80A CPU with serial & parallel I/O, 1K RAM, 8K ROM space, monitor PROM included.

CPC-30200A A & T	\$399.95
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THE BIG Z - Jade

2 or 4 MHz switchable Z-80 CPU board with serial I/O, accommodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600.

CPU-30201B Bare board w/manual	\$35.00
CPU-30201K Kit with manual	\$149.95
CPU-30210A A & T with manual	\$199.95

CB-2 - SSM Microcomputer

2 or 4 MHz Z-80 CPU board with provision for up to 8K of ROM or 4K of RAM on board, extended addressing, IEEE S-100, front panel compatible.

CPU-30300K Kit with manual	\$229.95
CPU-30300A A & T with manual	\$274.95

2810 Z-80 CPU - C.C.S.

2 or 4 MHz Z-80 CPU with serial I/O port & on-board monitor PROM, front panel compatible.

CPU-30400A A & T with PROM	\$289.95
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2820 Z-80 DMA CPU - C.C.S.

4 MHz Z-80 CPU board with 2 serial I/O ports & Centronics parallel I/O port, separate data & status ports, DMA daisy chain compatible.

CPU-30420A A & T with manual	\$569.95
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S-100 Disk Controllers

DISK 1 - CompuPro

8" or 5 1/4" DMA disk controller, single or double density, single or double sided, 10 MHz.

IOD-1810A A & T	\$449.95
IOD-1810C CSC	\$554.95
SFC-52506580F 8" CP/M 2.2 for Z-80	\$174.95
SFC-52506586F 8" CP/M 2.2 for 8086	\$299.95
SFO-54158000F Oasis single user	\$499.95
SFO-54158002F Oasis multi-user	\$849.95

VERSAFLOPPY II - SD Systems

Double density disk controller for any combination of 5 1/4" and 8" single or double sided, analog phase-locked loop data separator, vectored interrupts, CP/M 2.2 & Oasis compatible, control/diagnostic software PROM included.

IOD-1160A A & T with PROM	\$359.95
SFC-55009047F CP/M 2.2 with VF II	\$99.95

2242 DISK CONTROLLER - C.C.S.

5 1/4" or 8" double density disk controller with on-board boot loader ROM, free CP/M 2.2 & manual set.

IOD-1300A A & T with CP/M 2.2	\$399.95
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DOUBLE D - Jade

High reliability double density disk controller with on-board Z-80A, auxiliary printer port, IEEE S-100, can function in multi-user interrupt driven bus.

IOD-1200B Bare board & h/wr man	\$59.95
IOD-1200K Kit w/h/wr & s/wr man	\$299.95
IOD-1200A A & T w/h/wr & s/wr man	\$359.95
SFC-59002001F CP/M 2.2 with Double D	\$99.95

S-100 Memory Boards

256K RAMDISK - SD Systems

ExpandoRAM III expandable from 64K to 256K using 64K x 1 RAM chips, compatible with CP/M, MP/M, Oasis, Cromemco, & most other Z-80 based systems, functions as ultra-high speed disk drive when used with optional RAMDISK software.

MEM-65064A 64K A & T	\$474.95
MEM-65128A 128K A & T	\$574.95
MEM-65192A 192K A & T	\$674.95
MEM-65256A 256K A & T	\$774.95
SFC-55009000F RAMDISK s/wr CP/M 2.2	\$44.95
SFC-55009000F RAMDISK with EXRAM III	\$24.95

128K RAM 21 - CompuPro

128K x 8 bit or 64K x 16 bit static RAM board, 12 MHz, 24 bit addressing.

MEM-12810A A & T	\$1609.95
MEM-12810C CSC	\$1794.95

64K RAM 17 - CompuPro

64K CMOS static RAM board, 10 MHz, low power less than 4 watts, DMA compatible, 24 bit addressing.

MEM-64180A 64K A & T	\$549.95
MEM-64180C 64K CSC	\$698.95

64K RAM 16 - CompuPro

32K x 16 bit or 64K x 8 bit low power static RAM board, 10 MHz, 24 bit addressing.

MEM-32180A RAM 16 A & T	\$598.95
MEM-32180C RAM 16 CSC	\$698.95

64K STATIC RAM - SSM

IEEE 696/S-100 standard, up to 6MHz/8 Bit, 12MHz/16 Bit, 24 Bit extended addressing, disable-able in 2K increments

MEM-64300A A & T	\$499.95
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64K STATIC RAM - Mem Merchant

64K static S-100 RAM card, 4 to 16K banks up to 8 MHz.

MEM-64400A 64K A & T	\$499.95
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2065 64K RAM - C.C.S.

4 MHz bank port/bank byte selectable, extended addressing, 16K bank selectable, front panel compatible.

MEM-64565A 64K A & T	\$349.95
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2066 64K RAM - C.C.S.

64K RAM board with bank and block select switching functions for Cromemco Cromix & Alpha Micro.

MEM-64566A 64K A & T	\$424.95
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64K EXPANDORAM II - SD Systems

Expandable RAM board from 16K to 64K using 4116 RAM chips.

MEM-16630A 16K A & T	\$344.95
MEM-32631A 32K A & T	\$364.95
MEM-48632A 48K A & T	\$384.95
MEM-64633A 64K A & T	\$399.95

MEMORY BANK - Jade

4 MHz S-100 bank selectable expandable to 64K.

MEM-99730B Bare board w/manual	\$49.95
MEM-99730K Kit with no RAM	\$179.95
MEM-32731K 32K kit	\$199.95
MEM-64733K 64K kit	\$249.95
Assembled & Tested	add \$50.00

32K RAM 20 - CompuPro

32K static RAM, up to 10 MHz, disable-able in 4K banks, bank select or 24 bit addressing.

MEM-16180A 16K A & T	\$259.95
MEM-16180C 16K CSC	\$324.95
MEM-24180A 24K A & T	\$324.95
MEM-24180C 24K CSC	\$384.95
MEM-32185A 32K A & T	\$384.95
MEM-32185C 32K CSC	\$449.95

16K STATIC RAM - Mem Merchant

4MHz lo-power static RAM board, IEEE S-100, bank selectable, addressable in 4K blocks, disable-able in 1K segments extended addressing.

MEM-16171A 16K A & T	\$149.95
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S-100 I/O Boards

SYSTEM SUPPORT 1 - CompuPro

Real time clock, three 16 bit interval timers, dual interrupt controllers(15 levels), up to 4K EPROM/RAM, RS-232C serial channel, provision for 9511A/9512 math chip.

IOX-1850A SS1 A & T	\$359.95
IOX-1850C SS1 CSC	\$459.95
IOX-1855A with 9511 A & T	\$554.95
IOX-1855C with 9511 CSC	\$654.95
IOX-1860A with 9512 A & T	\$554.95
IOX-1860C with 9512 CSC	\$654.95

INTERFACER 1 - CompuPro

2 serial I/O ports 50-19.2K baud.

IOI-1810A A & T	\$218.95
IOI-1810C CSC	\$288.95

INTERFACER 2 - CompuPro

3 parallel, 1 serial, & interrupt timer.

IOI-1820A A & T	\$218.95
IOI-1820C CSC	\$288.95

INTERFACER 3 - CompuPro

5 or 8 channel serial I/O board for interrupt driven multi-user systems up to 250K baud.

IOI-1835A 5 port A & T	\$558.95
IOI-1835C 5 port CSC	\$628.95
IOI-1838A 8 port A & T	\$628.95
IOI-1838C 8 port CSC	\$749.95

INTERFACER 4 - CompuPro

3 serial, 1 parallel, 1 Centronics parallel.

IOI-1840A A & T	\$314.95
IOI-1840C CSC	\$414.95

MPX - CompuPro

Multi-user I/O multiplexer & interrupt controller with on-board 8085A-2 CPU & 4K or 16K of RAM.

IOI-1875A 4K MPX A & T	\$444.95
IOI-1875C 4K MPX CSC	\$534.95
IOI-1880A 16K MPX A & T	\$584.95
IOI-1880C 16K MPX CSC	\$674.95

I/O-8 - SSM Microcomputer

Eight software programmable serial I/O ports, 110 -19.2K Baud, ideal for multi-user systems

IOI-1018A A & T	\$469.95
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I/O-5 - SSM Microcomputer

Two serial & 3 parallel I/O ports, 110-19.2K Baud

IOI-1015A A & T	\$289.95
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MPC-4 - SD Systems

Intelligent 4-port serial I/O card, on-board Z-80A, 2K RAM, 4K PROM area, on-board firmware, fully buffered, vectored interrupts, four CTC channels, add to SD Board set for powerful multi-user system

IOI-1504A A & T w/software	\$495.00
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I/O-4 - SSM Microcomputer

2 serial I/O ports plus 2 parallel I/O ports.

IOI-1010B Bare board w/manual	\$35.00
IOI-1010K Kit with manual	\$179.95
IOI-1010A A & T with manual	\$249.95

2830 6 PORT SERIAL - C.C.S.

Six asynchronous RS-232C serial I/O ports with programmable baud rates.

IOI-1040A A & T with manual	\$529.95
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2710 4 PORT SERIAL - C.C.S.

Four RS-232C serial I/O ports with full handshaking.

IOI-1060A A & T with manual	\$319.95
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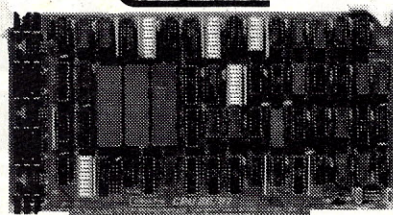
2719 2 SER & 2 PAR - C.C.S.

Two RS-232C serial I/O ports plus two 8 bit parallel I/O ports.

IOI-1080A A & T with manual	\$349.95
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Prices may be slightly higher at our retail locations. Please call the store nearest you for local price and availability.

1 ONE

CompuPro™


NEW! CPU BOARDS CO-PROCESSOR 8086/8087 (816)

16 bit 8 or 10 MHz 8086 CPU with sockets for 8087 and 80130

Part No.	Description	List Price	Our Price
KHGBT186A	A&T 8MHz 8086 only	\$695.00	\$ 625.00
KHGBT186C	CSC 10MHz 8086 only	\$850.00	\$765.00
KHGBT186A87	A&T with 8087 option	\$1295.00	\$1225.00
KHGBT186C87	CSC with 8087 option*	\$1550.00	\$1456.00

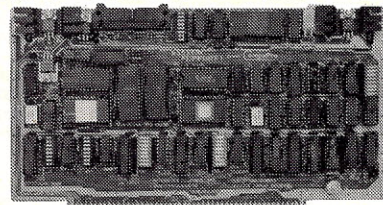
*8087 requires slower clock speeds

DUAL PROCESSOR 8085-8088

6 or 8 MHz Provides true 16 Bit Power with a standard 8 bit S-100 bus			
KHGBT1612A	A&T 6MHz	\$425.00	\$399.00
KHGBT1612C	CSC 6/8 MHz	\$525.00	\$498.00

CPU-Z Z80 CPU

2/4 MHz Z80 CPU 24 Bit Addressing			
KHGBT160A	A&T	\$295.00	\$280.00
KHGBT160C	CSC 3-6 MHz	\$395.00	\$375.00



I/O BOARDS

SYSTEM SUPPORT 1 MULTIFUNCTION BOARD

Serial port (software prog. baud), 4K EPROM or RAM provision, 15 levels of interrupt, real time clock, optional math processor

Part No.	Description	List Price	Our Price
KHGBT162A	Assembled & Tested	\$399.00	\$360.00
KHGBT162C	CSC	\$495.00	\$460.00
KHGBT8231	Math Chip		\$195.00
KHGBT8232	Math Chip		\$195.00
KHGBT162AM1	A&T with 8231 Math Chip		\$555.00
KHGBT162CM1	CSC w/8231 Math Chip		\$655.00
KHGBT162AM2	A&T w/8232 Math Chip		\$555.00
KHGBT162CM2	CSC w/8232 Math Chip		\$655.00

MPX CHANNEL BOARD

I/O Multiplexer, using 8085A-2 CPU on board with 4K RAM			
KHGBT166A	Assembled & Tested	\$495.00	\$445.00
KHGBT166C	CSC	\$595.00	\$535.00

With 16K RAM

KHGBT166A16	Assembled & Tested	\$649.00	\$585.00
KHGBT166C16	CSC	\$749.00	\$675.00

INTERFACER 1

Two Serial I/O

KHGBT133A	Assembled & Tested	\$249.00	\$219.00
KHGBT133C	CSC	\$324.00	\$298.00

INTERFACER 2

Three parallel, one serial I/O board

KHGBT150A	Assembled & Tested	\$249.00	\$219.00
KHGBT150C	CSC	\$324.00	\$298.00

INTERFACER 3

Eight channel multi-use serial I/O board

KHGBT1748A	Assembled & Tested	\$699.00	\$629.00
KHGBT1748C	CSC 200 hr. 8 Port	\$849.00	\$750.00
KHGBT1745A	Assembled & Tested	\$599.00	\$559.00
KHGBT1745C	CSC 200hr. 5 port	\$699.00	\$629.00

NEW!

INTERFACER 4

Three Serial, 1 Parallel, 1 Centronics Parallel

KHGBT187A	Assembled & Tested	\$350.00	\$315.00
KHGBT187C	CSC	\$450.00	\$415.00

SPECTRUM COLOR GRAPHICS

Color Graphics board with Parallel I/O

KHGBT144A	Assembled & Tested	\$399.00	\$349.00
KHGBT144C	CSC	\$449.00	\$399.00
KHGBT2D	Sublogic Universal Graphics Interpreter Software		\$35.00

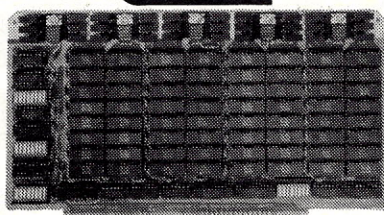
S-100 MOTHERBOARDS

Active termination, 6-12-20 Slot

KHGBT153A	A&T 6 slot, 2 lbs.	\$140.00	\$126.00
KHGBT153C	CSC 6 slot, 2 lbs.	\$190.00	\$176.00
KHGBT154A	A&T 12 slot, 3 lbs.	\$175.00	\$155.00
KHGBT154C	CSC 12 slot, 3 lbs.	\$240.00	\$220.00
KHGBT155A	A&T 20 slot, 4 lbs.	\$265.00	\$235.00
KHGBT155C	CSC 20 slot, 4 lbs.	\$340.00	\$310.00

ACTIVE TERMINATOR

Allows older S-100 motherboards to run faster and quieter			
KHGBT106A	Assembled & Tested		\$59.50

CompuPro™


STATIC MEMORY BOARDS RAM 20 - 32K STATIC RAM

RAM 20 10 MHz, 4K byte block disable, bank select or 24 bit addressing available 8, 16, 24 or 32K

Part No.	Description	List Price	Our Price
KHGBT164A8	8K A&T	\$210.00	\$190.00
KHGBT164A8C	8K CSC	\$280.00	\$260.00
KHGBT164A16	16K A&T	\$285.00	\$260.00
KHGBT164A16C	16K CSC	\$355.00	\$325.00
KHGBT164A24	24K A&T	\$355.00	\$325.00
KHGBT164A24C	24K CSC	\$425.00	\$385.00
KHGBT164A32	32K A&T	\$425.00	\$385.00
KHGBT164A32C	32K CSC	\$495.00	\$450.00

CMOS STATIC RAM

For a complete analysis of the advantages of CMOS memory, see the "Product Description" on page 416 of the January Issue of BYTE

RAM 17 - 64K CMOS STATIC RAM

RAM 17, 10 MHz, 2 Watt, DMA Compatible 24 Bit Addressing			
KHGBT175A64	64K A&T	\$599.00	\$550.00
KHGBT175C64	64K CSC	\$750.00	\$699.00

RAM 16 - 32K x 16 BIT CMOS STATIC RAM

8 and/or 16 Bit			
(816) RAM 16 10 MHz, 32K x 16 or 64K x 8			
IEEE/696 16 Bit 2 Watt, 24 Bit Addressing			
KHGBT180A	64K A&T	\$650.00	\$599.00
KHGBT180C	64K CSC	\$750.00	\$699.00

NEW! RAM 21 - 128K STATIC RAM

RAM 21 12MHz, 128K x 8 or 64K x 16			
IEEE/696 8 or 16 Bit 1.2 Amps, 24 Bit Addressing			
KHGBT190A	128K A&T	\$1695.00	\$1610.00
KHGBT190C	128K CSC	\$1895.00	\$1795.00

M-DRIVE SOLID STATE DISK DRIVE, (816)

3500% FASTER!

Not Really, But the Next Best Thing for CompuPro 8085/88 Users. Call for Detail on M-Drive.

M-Drive requires a 6MHz CPU 8085/88 dual processor, Disk 1 DMA disk controller and System Support 1 Multifunction Board

KHGBTMD128K	128K of A&T memory & M-Drive Software	\$1198.00
KHGBTMD128KC	128K of CSC memory & M-Drive Software	\$1398.00
KHGBTMD256KA	256K of A&T memory & M-Drive Software	\$2395.00
KHGBTMD256KC	256K of CSC memory & M-Drive Software	\$2795.00

DISK CONTROLLERS


FREE CP/M 2.2

DISK 1 FLOPPY CONTROLLER

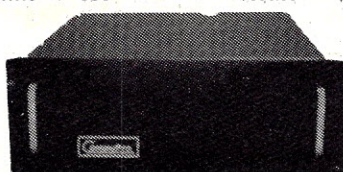
Fast DMA, Soft Sector, Controls 8" or 5 1/4" Single or Double Density. OUR BEST!

KHGBT171ACPM	A&T w/CP/M 2.2 & BIOS	\$670.00	\$450.00
KHGBT171C	CSC	\$595.00	\$555.00
KHGBTCPM80*	CP/M 2.2 for Z80/8085 with manuals & BIOS 8" S/D disk		\$175.00
KHGBTCPM86	CP/M for 8086 with manuals & BIOS 8" S/D disk		\$300.00
KHGBTOAS8S	Oasis 8 bit single user 8" S/D disk		\$500.00
KHGBTOAS8M	Oasis 8 bit multiuser, 8" S/D disk		\$850.00

NEW! DISK 2/SELECTOR CHANNEL

HARD DISK CONTROLLER

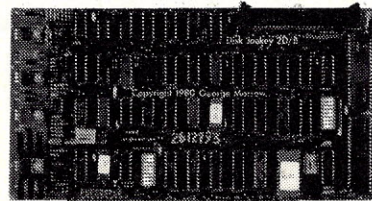
Fast DMA 2 board set. Controls 4 Shugart 4000 series or Fujitsu 2300 type drives			
KHGBT177A	Assembled & Tested	\$795.00	\$750.00
KHGBT177C	CSC	\$895.00	\$850.00



S-100 MAINFRAME

110V 60Hz CVT Mainframe uses famous 20 slot COMPUPRO Motherboard. 55 lbs.			
KHGBTENC20RM	20 Slot Rack Mount	\$895.00	\$825.00
KHGBTENC20DK	20 Slot Desk Top	\$825.00	\$760.00

Turn page for complete CompuPro Systems

**MORROW
DESIGNS**


FLOPPY DISK CONTROLLERS & SUBSYSTEMS

DISK JOCKEY 2B FLOPPY CONTROLLER

Memory mapped controller handles 4 8" drives, single or double density

Part No.	Description	List Price	Our Price
KHMDSDJ2208	A&T w/CP/M™ 2.2	\$399.00	\$375.00

DISCUS 2D & DISCUS 2+2 SUBSYSTEMS

Each subsystem includes DJ/2B controller 8" double density drives with cabinet, power supply, CP/M™ 2.2 and Microsoft Basic

SINGLE SIDED - DISCUS 2D

KHMSDF1218	1 Drive 30 lbs.	\$1095.00	\$ 950.00
KHMSDF1228	2 Drive 48 lbs.	\$1875.00	\$1675.00

DOUBLE SIDED - DISCUS 2+2

KHMSDF812	1 Drive 30 lbs.	\$1395.00	\$1250.00
KHMSDF822	2 Drive 48 lbs.	\$2495.00	\$2200.00

DISK JOCKEY/DMA FLOPPY CONTROLLER

DMA Controller supports 4 soft-sectored 8" drives and 4 10 sector 5 1/4" drives simultaneously. On board Z80A

KHMDSDJDMA	A&T w/CP/M™ 2.2	\$495.00	\$450.00
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DISK JOCKEY DMA SUBSYSTEMS

Each subsystem includes DJ/DMA controller, 8" double-density drives or 5 1/4" 48 TPI drives, cabinet, power supply, CP/M™ 2.2 and Microsoft BASIC

SINGLE SIDED DISCUS 2D/DMA

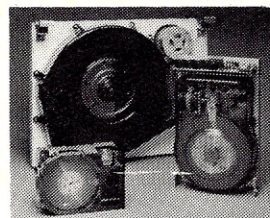
KHMSDF811	1 Drive 30 lbs.	\$1195.00	\$1050.00
KHMSDF821	2 Drive 48 lbs.	\$1975.00	\$1775.00

DOUBLE SIDED DISCUS 2+2/DMA

KHMSDF812	1 Drive 30 lbs.	\$1495.00	\$1325.00
KHMSDF822	2 Drive 48 lbs.	\$2575.00	\$2295.00

DOUBLE SIDED - DISCUS MINI-FLOPPY/DMA

KHMSDF5124	1 Drive - 17 lbs.	\$ 995.00	\$895.00
KHMSDF5224	2 Drive 32 lbs.	\$1695.00	\$1525.00



NEW! S-100 5-26 MB HARD DISK SUBSYSTEMS 5 - 10 Mb DMA SUBSYSTEMS

Each subsystem includes DMA Hard Disk Controller, Seagate ST506 5 Mb or ST412 10 Mb 5 1/4" Hard Disk, Cabinet, power supply, CP/M™ 2.2 and Microsoft BASIC.

KHMSDMAM*	Software supplied on 8" IBM 3740 disk with blank I/O and INSTALL program		
KHMSDMAM*2B	Software configured for Morrow DJ/2B controller and Mult I/O as console		
KHMSDMAM*DMA	Software configured for Morrow DJ/DMA controller and Mult I/O as console		
KHMSDMAM*NS	Software supplied on 5 1/4" 10 sector North Star disk with blank I/O and INSTALL Program		

Replace * in above part numbers with 5 for 5Mb Subsystems or 10 for 10Mb Subsystems.

DISCUSM5 - 5Mb Subsystems	\$2195.00	\$1975.00
DISCUSM10 - 10Mb Subsystems	\$3195.00	\$2875.00

(order by part numbers listed above)

DISCUS HDC 20-26 Mb SUBSYSTEMS

Each subsystem includes HDCA3 I/O mapped controller, Shugart SA4008 14" 26Mb or Fujitsu 2308 8" 20Mb Hard Disk, cabinet, power supply, CP/M™ 2.2 and Microsoft BASIC.			
KHMSDHC20	Discus M20 A&T	\$4795.00	\$3995.00
KHMSDHC26	Discus M26 A&T	\$4495.00	\$3895.00

I/O BOARDS

MULTI I/O

Three Serial, Two Parallel			
KHMSMB3200	Assembled & Tested	\$359.00	\$329.00

SWITCHBOARD

Two serial I/O, four parallel I/O, one status port, one strobe port

KHMSB2411	\$299.00	\$269.00
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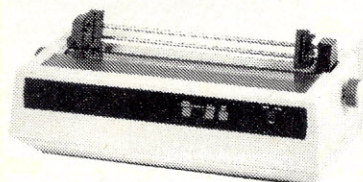
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FUJITSU

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NEC

LETTER QUALITY PRINTERS FROM SELLUM



Speed and Unmatched Performance

Interfaces: • RS232C and Current Loop • Centronics type parallel interface • IEEE488 All are DIP switch selectable.
Personality Protocols: • NEC5510 • DIABLO 630 • QUME Sprint 9 • IBM Personal Computer • ATARI (Centronics 737).
Special Features: • Z80 CPU • 12K ROM • Standard 16K Buffer • Optional 48K Buffer • 50 - 192K baud • Micro-coded alarm differentiates error conditions with pulse combinations • Intelligent bi-directional printing with logic seeking • Complete word processing features • Self test • Auto reprint • Auto clear error • Proportional spacing • Supports Automatic justification • Complete Vector plotting routines • Sheet feeder mode allows easy interface to most mechanical sheet feeders • 6 month warranty • Quiet - 60db • Front panel forms control • Universal power supply 115/220V 50/60 Hz.

BEST BUY! 80 Characters per Second! LETTER QUALITY! USING THE FUJITSU SP830 WOW!

Part No.	Description	List Price	Our Price
KHSLMF86	Intelligent Printer	\$3495.00	\$2995.00
OPTIONS			
KHSLMF86VFT	Vertical forms tractor		\$200.00
KHSLMF8648K*	48K RAM buffer		\$400.00
Call for pricing on sheet feed options			
KHSLMN77	Intelligent Printer	\$3295.00	\$2895.00
OPTIONS			
KHSLMN77VFT	Vertical Forms Tractor		\$ 230.00
KHSLMN77B0FT	Bidirectional Forms Tractor		\$ 400.00
KHSLMN77CSF	NEC Cut Sheet Feeder		\$1595.00
KHSLMN77CSF2	Twin Cut Sheet Feeder		\$2150.00
KHSLMN7748K*	48K RAM Buffer		\$ 400.00

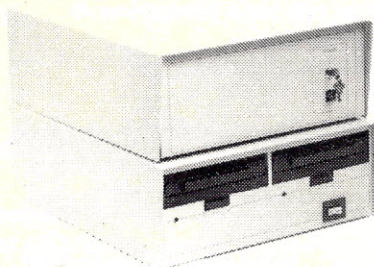
*Must be ordered with the printer

INTERFACE CABLES

KHCPAM572	Centronics IBM/NEC Cable	\$80.00
KHSC0251	RS232C Serial Cable	\$60.00

Call for other cables not listed

Para Dynamics



18 SLOT S-100 MAINFRAME

CVT Power Supply, forced air cooling; security lock 120 or 220V AC at 50 or 60Hz+8V@20A, ±16@3.5
 KHPON2018D Desk Top \$799.00 \$699.00
 KHPON2018R Rack Mount \$849.00 \$749.00

8 SLOT S-100 MAINFRAME WITH CUTOFFS FOR 2 5 1/4" DISK DRIVES

+5@5A, -5@500MA, +8@15A, +12@6A, +16@2, -16@2
 KGPON2508D Desk Top \$899.00 \$789.00
 KGPON2508R Rack Mount \$949.00 \$839.00

DISK DRIVE FACILITY

Accommodates two 8" floppy drives, of Shugart, Qume, or similar design and dimensions. 110 or 220V AC at 50 or 60Hz CVT power.

KGPON2200D	Desk Top	\$659.00	\$579.00
KGPON2200R	Rack Mount	\$679.00	\$595.00

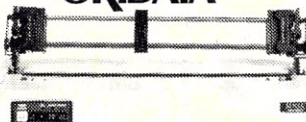


Free standing cabinet. Will accept 2, 8" Floppy disks and 1, 8" Rigid disk. 18 slot card cage will accept the double height 10" x 10" S-100 cards (Alpha Micro and others) CVT Power Supply.

KGPON2818	PRONTO	\$1295.00	\$1129.00
PRONTO COMPLETE WITH POWER SUPPLY POWER-UP SEQUENCER			
KGPON2818S	with sequencer	\$1395.00	\$1249.00

Shipped motor freight collect

OKIDATA



COMPARE OKIDATA'S FEATURES TO ANY OTHER PRINTER! COMPARE PRIORITY ONE'S PRICES TO ANY - THEN DECIDE! Don't be fooled by those who try to "soak" you for the options

- BI-DIRECTIONAL-120 CPS • Both Parallel and 1200
- 9 x 9 Matrix (Alphanumeric) baud Serial I/O (82A & 83A)
- 6x9or12 Matrix for graphics • Self Test
- 5,8,3, 10, 16 Characters • Out of Paper Switch
- Per Inch • Friction or Optional Tractor
- 80 CPL @ 10 CPI for 82A • Feed (Tractor Standard on 84)
- 132 CPL @ 100CPI for • 10 different character sets 83A & 84

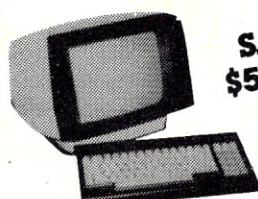
All three printers feature front panel switch selectable for lengths; 10 lengths from 3" to 14". Front or bottom paper loading for up to 4 part forms and tear bar. All of these features make OKIDATA the best value in low cost printers!

Part No.	Description	List Price	SALE
KHOKIDAT82AT	80 column printer w/friction (25 lbs.)	\$539.00	
KHOKID82TRK	Tractor Feed for OKIDAT 82A	\$ 59.95	
KHOKIGRAPH82	High Resolution graphics ROM 60 x 66	\$ 75.00	
KHPOBOKI82ATG	OKIDAT82A w/tractor and graphics	\$599.00	
KHOKIDAT83A	132 column printer w/friction (35 lbs.)	\$750.00	
KHOKI83TRK	Tractor Feed for OKIDAT83A	\$ 59.95	
KHOKIGRAPH83	High Resolution graphics ROM 60x66	\$ 75.00	
KHPOBOKI83ATG	OKIDAT83A w/tractor & graphics	\$850.00	
KHOKISER2KBF	9600 Baud 2K serial buffer/interface	\$149.00	
KHOKIDAT84AP	132 col. printer parallel interface	\$1095.00	
	with graphics and tractor (35 lbs.)		
KHOKIDAT84AS	132 col. printer 9600 baud serial 2K	\$1250.00	
	interface, graphics and tractor (35 lbs.)		
KHMBASAPLWTWC*	Apple Parallel Interface w/Cable	\$ 75.00	

*Sold only with printer

COMPARE PRICES!!

ADDS
Applied Digital Data Systems Inc.



SALE!
\$525.00

VIEWPOINT - ADDS

Detachable keyboard, RS232 interface and auxiliary port, 80 x 24 display, tiltable screen.
 KHADDVWPR Sh. weight: 30 lbs. \$699.00 \$525.00

DISK CABINETS

V-100 - VISTA

- Desk or rack mountable • Internal power and data cables
- Drives pull out for easy service and maintenance
- KHVISV100 Disk Drive Cabinet (43 lbs) \$495.00 \$449.00
- KHVISV100 With purchase of two 8" Disk Drives \$399.00

SINGLE 8" - Q.T.

Single 8" cabinet with power supply (22 lbs.) \$249.00 \$225.00

DUAL 8" - Q.T.

Dual 8" cabinet with power supply (24 lbs.) \$395.00 \$349.00

5" CABINETS - VISTA

Single 5" with P.S. \$ 85.00
 Dual 5" with P.S. \$110.00

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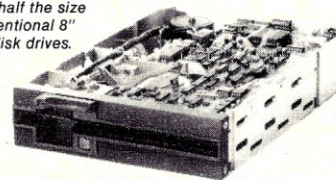
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Tandon

Tandon TM-800 Thinline is exactly half the size of conventional 8" floppy disk drives.



ONE

Exactly one-half the height of any other model. Proprietary, high-resolution, read-write heads patented by Tandon. D.C. only operation - no A.C. required. Industry standard interface.

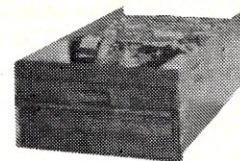
	Three millisecond track-to-track access time	(9 lbs.)
KHNTDTM8481	Single Sided \$425.00	2 or more \$395.00
KHNTDTM8482	Double Sided \$575.00	2 or more \$550.00
KHNTDTM8M	Manual - not included with drive	\$ 10.00

TANDON 5 1/4" DRIVES

KHNTDTM1001	Single Sided, 250KB (5 lbs.)	\$249.00* ea
	2 or More \$220.00	
KHNTDTM1002	Double Sided, 500KB	\$325.00 ea.
	2 or More \$299.00	
KHNTDTM1003	Single Sided, 500KB	\$325.00 ea.
	2 or More \$299.00	
KHNTDTM1004	Double Sided, 1000KB	\$449.00 ea.
	2 or More \$420.00	
KHNTDTM5M	manual, not included with drive	\$ 10.00

*As used in the IBM P.C.

MITSUBISHI ELECTRIC



Better Than QUME!
Better Than SHUGART!

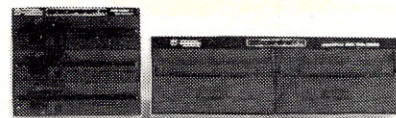
8", Double-sided, double-density, interchangeable with QUME & Shugart	
KHMITM289463	Sh. Weight 16 lbs. \$550.00
KHMITM289463M	Manual \$ 10.00
	2 or More \$525.00 each

Shugart 801R

Single sided, double density - most popular 8" drive	
KHSHU801R	\$425.00 ea. or 2 or more (16 lbs) for \$395.00 ea.
KHSHUS801RM	Manual for 801R drives \$ 10.00



INTERNATIONAL INSTRUMENTATION, INC.



UNIVERSAL DISK ENCLOSURES

- Accepts any combination of 8" drives (QUME/Shugart 801R type or 1/2 size Tandon type) • Also accepts hard disks • Positive pressure • Optional Disk environment monitor shows supply voltage and internal cabinet temperature • Internal power and data cables provided.

UNIVERSAL DRIVE CABINET complete with power supply, fan and filter, and all internal cables for attachment of two 8" floppy drives.

KHIIUDE004	Dual Drive Cabinet (Sh. Wt. 40 lbs)	\$495.00	\$450.00
KHIIUDE004	With purchase of two 8" Disk Drives		\$399.00
KHIIUDE004EM	w/Environmental Monitor installed	\$584.95	\$535.00
KHIIUDE004EM	With purchase of two 8" Disk Drives		\$485.00
KHIIUDE004AUG	Dual Drive cabinet with Augmentation power supply module to increase 5V supply from 6 amps to 9 amps for use with two hard disks or 4 Tandon drives. Also includes Disk Environment Monitor (45 lbs.)	\$733.00	\$650.00

19" Rack Mount kit UDE004 \$ 89.95

THIN THREE DRIVE CABINET complete with power supply, and all internal cables for attachment of three thin 8" floppy drives (Tandon type). One AC power connector is also provided for use with full size drive.

KHIIUDET	Three Drive Cabinet (Sh. Wt. 35 lbs)	\$495.00	\$450.00
KHIIUDETTEM	with Environmental Monitor installed	\$584.95	\$535.00



FOR ONLY \$129.95 Learn Computing From The Ground Up

Build a Computer kit that grows with you, and can expand to 64k RAM, Microsoft BASIC, Text Editor/Assembler, Word Processor, Floppy Disks and more.

EXPLORER/85

Here's the low cost way to learn the fundamentals of computing, the all-important basics you'll need more and more as you advance in computer skills. For just \$129.95 you get the advanced-design Explorer/85 motherboard, with all the features you need to learn how to write and use programs. And it can grow into a system that is a match for any personal computer on the market. Look at these features: 8085 Central Processing Unit, the microprocessor "heart" of the Explorer/85. (Join the millions who will buy and use the 8085/8085 this year alone). • Four 8-bit plus one 6-bit input/output ports from which you can input and output your programs, as well as control exterior switches, relays, lights, etc. • a cassette interface that lets you store and reload programs you've learned to write. • deluxe 2,000 byte operating system/monitor makes it easy to learn computing in several important ways: • It allows simpler, faster writing and entering of programs. • It permits access by you to all parts of the system so you can check on the status of any point in the program. • It allows tracing each program step by step, with provision for displaying all the contents of the CPU (registers, flags, etc.) • and it does much more.

You get all this in the starting level (Level A) of the Explorer/85 for only \$129.95. Incredible! To use, just plug in your 8VDC power supply and terminal or keyboard/display — if you don't have them, see our special offers below.

□ Level A computer kit (Terminal Version) ... \$129.95 plus \$3 P&I.*
□ Level A kit (Hex Keypad/Display Version) ... \$129.95 plus \$3 P&I.*

LEVEL B — This "building block" converts the motherboard into a two-slot 5100 bus (industry standard) computer. Now you can plug in any of the hundreds of 5100 cards available.
□ Level B kit ... \$49.95 plus \$2 P&I.*
□ 5100 bus connectors (two required) ... \$4.85 each, postpaid.

LEVEL C — Add still more computing power. The "building block" mounts directly on the motherboard and expands the 5100 bus to six slots.
□ Level C kit ... \$39.95 plus \$2 P&I.*
□ 5100 bus connectors (five required) ... \$4.85 each, postpaid.

LEVEL D — When you reach the point in learning that requires more memory, we offer two choices: either add 4k of a memory directly on the motherboard, or add 16k to 64k of memory by means of a single 5100 card, our famous "JAWS".
Level D kit (CHECK ONE) ... □ 4k on-board ... \$49.95 plus \$2 P&I.* □ 16k 5100 "JAWS" ... \$149.95 plus \$2 P&I.* □ 32k 5100 "JAWS" ... \$199.95 plus \$2 P&I.* □ 48k 5100 "JAWS" ... \$249.95 plus \$2 P&I.* □ 64k 5100 "JAWS" ... \$299.95 plus \$2 P&I.*

LEVEL E — An important "building block" it activates the 8k ROM/EPROM space on the motherboard. Now just plug in our 8k Microsoft BASIC or your own custom programs.
□ Level E kit ... \$5.95 plus \$2 P&I.*

Microsoft BASIC — It's the language that allows you to talk English to your computer! It is available three ways: □ 8k cassette version of Microsoft BASIC (requires Level B and 12k of RAM minimum; we suggest a 16k 5100 "JAWS" — see above) ... \$64.95 postpaid.
□ 8k ROM version of Microsoft BASIC (requires Level B and Level E and 4k RAM; just plug into your Level E sockets. We suggest either the 4k Level D RAM expansion or a 16k 5100 "JAWS") ... \$69.95 plus \$2 P&I.*
□ Disk version of Microsoft BASIC (requires Level B, 32k of RAM, floppy disk controller, 8" floppy disk drive) ... \$325 postpaid.

TEXT EDITOR/ASSEMBLER — The editor/assembler is a software tool (a program) designed to simplify the task of writing programs. As your programs become longer and more complex, the assembler can save you many hours of programming time. This software includes an editor program that enters the programs you write, makes changes, and saves the programs on cassettes. The assembler performs the clerical task of translating symbolic code into the computer-readable object code. The editor/assembler program is available either in cassette or a ROM version.
□ Editor/Assembler (Cassette version; requires Level B and 8k (min.) of RAM — we suggest 16k "JAWS" — see above) ... \$59.95 plus \$2 P&I.*
□ Editor/Assembler (ROM version; supplied on an 5100 card; requires Level B and 4k RAM (min.) — we suggest either Level D or 16k "JAWS") ... \$99.95 plus \$2 P&I.*

8" FLOPPY DISK — A remarkable "building block." Add our 8" floppy disk when you need faster operation: more convenient program storage, perhaps a business application, and access to the literally thousands of programs and program languages available today. You simply plug them into your Explorer/85 disk system — it accepts all IBM-formatted CP/M programs.
□ 8" Floppy Disk Drive ... \$499.95 plus \$12 P&I.*
□ Floppy Controller Card ... \$199.95 plus \$2 P&I.*
□ Disk Drive Cabinet & Power Supply ... \$69.95 plus \$3 P&I.*
□ Drive Cables (set up for two drives) ... \$25.00 plus \$1.50 P&I.*

□ CP/M 2.2 Disk Operating System; includes Text Editor/Assembler, dynamic debugger, and other features that give your Explorer/85 access to thousands of existing CP/M-based programs ... \$150.00 postpaid.

NEED A POWER SUPPLY? Consider our AP-1. It can supply all the power you need for a fully expanded Explorer/85 (note: disk drives have their own power supply). Plus the AP-1 fits neatly into the attractive Explorer steel cabinet (see below).
□ AP-1 Power Supply kit (8V @ 5 amps) in deluxe steel cabinet ... \$39.95 plus \$2 P&I.*

NEED A TERMINAL? We offer you choices: the least expensive one is our Hex Keypad/Display kit that displays the information on a calculator-type screen. The other choice is our ASCII Keyboard/Computer Terminal kit, that can be used with either



1. Plug in Netronic's Hex Keypad/Display
2. Add Level B to convert to 5100
3. Add 4k RAM
4. Plug in Level E; here, accepts Microsoft BASIC or Editor/Assembler in ROM
5. Add two 5100 boards
6. Add your own custom circuits (prototyping area)
7. Connect terminal

a CRT monitor or a TV set (if you have an RF modulator).
□ Hex Keypad/Display kit ... \$69.95 plus \$2 P&I.*

□ **FASTERM-64 TERMINAL KIT** — Featuring a 56 key ASCII Keyboard, 128 character set upper and lower case, 75 ohm output, 8 baud rates, 150 to 19,200 (switch selectable) RS232C or 20 MA output, 32 or 64 character by 16 line formats, complete with Deluxe Steel Cabinet and Power Supply ... \$199.95 plus \$3 P&I.*

□ **RF Modulator kit** (allows you to use your TV set as a monitor) ... \$6.95 postpaid.

□ **12" Video Monitor** (10MHz bandwidth) ... \$139.95 plus \$5 P&I.*

□ **Deluxe Steel Cabinet** for the Explorer/85 ... \$49.95 plus \$3 P&I.*

□ **Fan for cabinet** ... \$15.00 plus \$1.50 P&I.*

ORDER A SPECIAL-PRICE EXPLORER/85 PAK — THERE'S ONE FOR EVERY NEED.

□ **Beginner Pak** (Save \$26.00) — You get Level A (Terminal Version) with Monitor Source Listing (\$25 value) AP-1, 5-amp power supply, Intel 8085 Users Manual ... (Reg. \$199.95) SPECIAL \$169.95 plus \$4 P&I.*

□ **Experimenter Pak** (Save \$53.40) — You get Level A (Hex Keypad/Display Version) with Hex Keypad/Display, Intel 8085 User Manual, Level A Hex Monitor Source Listing, and AP-1, 5-amp power supply ... (Reg. \$279.95) SPECIAL \$229.95 plus \$6 P&I.*

□ **Special Microsoft BASIC Pak** (Save \$103.00) — You get Levels A (Terminal Version), B (4k RAM), E, 8k Microsoft in ROM, Intel 8085 User Manual, Level A Monitor Source Listing, and AP-1, 5-amp power supply ... (Reg. \$439.70) SPECIAL \$339.95 plus \$7 P&I.*

□ **Add a Rom-Version Text Editor/Assembler** (Requires Levels B and D or 5100 Memory) ... \$99.95 plus \$2 P&I.*

Starter 8" Disk System — Includes Level A, B floppy disk controller, one CDC 8" disk-drive, two-drive cable, two 5100 connectors; just add your own power supplies, cabinets and hardware ... □ (Reg. \$1065.00) SPECIAL \$999.95 plus \$13 P&I.* □ 32k Starter System, \$1045.95 plus \$13 P&I.* □ 48k Starter System, \$1095.95 plus \$13 P&I.* □ 64k Starter System, \$1145.95 plus \$13 P&I.*

□ Add to any of above Explorer steel cabinet, AP-1 5-amp power supply, Level C with two 5100 connectors, disk drive cabinet and power supply, two sub-D connectors for connecting your printer and terminal ... (Reg. \$225.95) SPECIAL \$199.95 plus \$3 P&I.*

□ **Complete 64K System**, Wired & Tested ... \$1650.00 plus \$26 P&I.*

□ **Special Complete Business Software Pak** (Save \$625.00) — Includes CP/M 2.2 Microsoft BASIC, General Ledger, Accounts Receivable, Accounts Payable, Payroll Package ... (Reg. \$1325) SPECIAL \$699.95 postpaid.

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Acct. No. _____ Exp. Date _____

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ANNOUNCING TWO NEW TERMINALS

Smart • Fast • Graphics • Matching Modem and \$295 Printer

Netronics announces a state of the art breakthrough in terminals, now at prices you can afford, you can go on-line with data-bank and computer phone-line services. It's all yours: "electronic newspapers," educational services, Dow-Jones stock reports, games, recipes, personal computing with any level language, program exchanges, electronic bulletin boards ... and more every day!!!

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CD4008	.39	CD4105	2.49
CD4009	.39	CD4106	2.49
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CD4011	.39	CD4108	2.49
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CD4016	.39	CD4113	2.49
CD4017	.39	CD4114	2.49
CD4018	.39	CD4115	2.49
CD4019	.39	CD4116	2.49
CD4020	.39	CD4117	2.49
CD4021	.39	CD4118	2.49
CD4022	.39	CD4119	2.49
CD4023	.39	CD4120	2.49
CD4024	.39	CD4121	2.49
CD4025	.39	CD4122	2.49
CD4026	.39	CD4123	2.49
CD4027	.39	CD4124	2.49
CD4028	.39	CD4125	2.49
CD4029	.39	CD4126	2.49
CD4030	.39	CD4127	2.49
CD4031	.39	CD4128	2.49
CD4032	.39	CD4129	2.49
CD4033	.39	CD4130	2.49
CD4034	.39	CD4131	2.49
CD4035	.39	CD4132	2.49
CD4036	.39	CD4133	2.49
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2103	1024K (450K) L.P.	1.75	
2111 (8111)	256K (450K)	3.95	
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2113	1024K (450K)	2.25	8-1/16
2114	1024K (450K) L.P.	2.49	8-1/16
2115	1024K (450K)	2.49	8-1/16
2116	1024K (450K) L.P.	2.49	8-1/16
2117	1024K (450K)	2.49	8-1/16
2118	1024K (450K)	2.49	8-1/16
2119	1024K (450K)	2.49	8-1/16
2120	1024K (450K)	2.49	8-1/16
2121	1024K (450K)	2.49	8-1/16
2122	1024K (450K)	2.49	8-1/16

Mini Stereo AM/FM Receiver

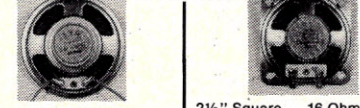
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FEATURES: Lightweight headphones. Left/right balance control. Full fidelity stereo sound. Additional black soft carrying case & shoulder strap. Belt clip (hands free). Operates on 3 AA cell batteries (not incl.). Compact size: 3 1/2" x 4 1/2" x 1". Wt. 6 oz.

Model 2830 List Price \$89.95 **\$34.95**

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Model 5VW3901 **\$49.95**

UV-EPROM Eraser

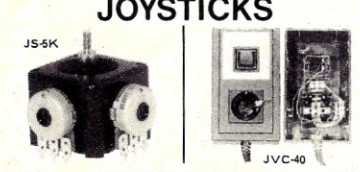


Erases 2708, 2716, 2732, 2764, 2516, 2532, 2564. Erases up to 8 chips within 15 minutes (1 chip in 37 minutes). Maintains constant exposure distance of one inch. Special conductive foam liner eliminates static build-up. Built-in safety lock to prevent UV exposure. Compact — only 9.00" x 3.70" x 2.60". Complete with holding tray for 8 chips.

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FOR TRS-80 MODEL II (Industry Standard). Features single or double density. Recording mode: FM single, MFM double density. Power: +12VDC (±0.8V) 1.6 amps max., 5VDC (±0.25V) 0.6 amps max. Unit as pictured at left (does not incl. case, power supply or cables). 30-page data book included. Weighs 3 1/2 pounds. Size: 5 1/4" W x 8" D x 3 1/4" H.

FD200 **\$179.95**
Single-sided, 40 tracks, 250K bytes capacity

FD250 **\$199.95**
Double-sided, 35 tracks, 438K bytes capacity

JE215 Adjustable Dual Power Supply

General Description: The JE215 is a Dual Power Supply with independent adjustable positive and negative output voltages. A separate adjustment for each of the supplies provides the user unlimited applications for IC current voltage requirements. The supply can also be used as a general all-purpose variable power supply.

- FEATURES:**
- Adjustable regulated power supplies, pos. and neg. 1.2VDC to 15VDC.
 - Power Output (each supply): 5VDC @ 500mA, 10VDC @ 750mA, 12VDC @ 500mA, and 15VDC @ 175mA.
 - Two, 3-terminal adj. IC regulators with thermal overload protection.
 - Heat sink regulator cooling.
 - LED "on" indicator.
 - Printed Board Construction.
 - 120VAC input.
 - Size: 3-1/2" W x 5-1/16" L x 2" H

JE215 Adj. Dual Power Supply Kit (as shown) **\$24.95**

(Picture not shown but similar in construction to above)

JE200 Reg. Power Supply Kit (5VDC, 1 amp) **\$14.95**

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JE210 Var. Pwr. Sply. Kit, 5-15VDC, to 1.5amp **\$19.95**

KEYBOARDS — POWER SUPPLIES

JE610 ASCII Encoded Keyboard Kit

The JE610 ASCII Keyboard Kit can be interfaced into most any computer system. The kit comes complete with industrial grade keyboard switch assembly (62-keys), IC's, sockets, connector, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and -12V @ 10mA for operation. Features: 60 keys generate the 126 characters, upper and lower case ASCII set. Fully buffered. Two user-definable keys provided for custom applications. Caps lock for upper-case-only arrays. Easy interfacing with a 16-pin dip or 16-pin edge connector. Size: 3 1/4" H x 14 1/4" W x 8 1/4" D.

JE610/DTE-AK (After assembly as pictured above) **\$124.95**

JE610 Kit 62-Key Keyboard, PC Board & Components (no case) **\$ 79.95**

K62 62-Key Keyboard (Keyboard only) **\$ 34.95**

DTE-AK (case only — 3 1/4" H x 11" W x 8 3/4" D) **\$ 49.95**

JE212 — Negative 12VDC Adapter Board Kit for JE610 ASCII KEYBOARD Kit Provides — 12VDC from incoming 5VDC **\$9.95**

JE600 Hexadecimal Encoder Kit

FULL 8-BIT LATCHED OUTPUT 19-KEY KEYBOARD

The JE600 Encoder Keyboard Kit provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8-bit microprocessor or 8-bit memory circuits. Three additional keys are provided for user operations with one having a bistable output available. The outputs are latched and monitored with 9 LED readouts. Also included is a key entry strobe. Features: Full 8-bit latched output for microprocessor use. Debounce + 5VDC required for operation. Size: 3 1/4" H x 8 1/4" W x 8 1/4" D.

JE600/DTE-HK (After assembly as pictured above) **\$99.95**

JE600 Kit 19-Key Hexadecimal Keyboard, PC Board & Components (no case) **\$59.95**

K19 19-Key Keyboard (Keyboard only) **\$14.95**

DTE-HK (case only — 3 1/4" H x 8 1/4" W x 8 3/4" D) **\$44.95**

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DJ4-3	924102-36	14	single end 36"	36"	2.35
DJ4-14	924106-12	14	double end 12"	12"	3.29
DJ4-14-14	924106-24	14	double end 24"	24"	3.49
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DJ16-2	924112-24	16	single end 24"	24"	2.19
DJ16-3	924112-36	16	single end 36"	36"	2.59
DJ16-16	924116-12	16	double end 12"	12"	3.15
DJ16-16-16	924116-24	16	double end 24"	24"	3.39
DJ16-16-16-16	924116-36	16	double end 36"	36"	4.05
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DJ24-2	924122-24	24	single end 24"	24"	3.39
DJ24-3	924122-36	24	single end 36"	36"	3.95
DJ24-1-24	924126-12	24	double end 12"	12"	2.79
DJ24-1-24-24	924126-24	24	double end 24"	24"	5.29
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Keyboard / Pad: 5amp.: Reference Manl.
\$95.00 : \$124.00 : \$18.00

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*Bus Oriented

*4 Bit Data Bus

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*R/W Hold Selec. +

*Inter. Signal

*32.768KHz. xtal Control.

*5v Pow. Sup.

*Low Power Dissipation

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7404	.23	7458	.30
7405	.18	7459	.55
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7411	.22	7461	3.00
7412	.22	7462	2.50
7413	.22	7463	2.50
7414	.22	7464	2.50
7415	.24	7465	2.50
7416	.24	7466	2.50
7417	.24	7467	2.50
7418	.24	7468	2.50
7419	.24	7469	2.50
7420	.24	7470	2.50
7421	.24	7471	2.50
7422	.24	7472	2.50
7423	.24	7473	2.50
7424	.24	7474	2.50
7425	.24	7475	2.50
7426	.24	7476	2.50
7427	.24	7477	2.50
7428	.24	7478	2.50
7429	.24	7479	2.50
7430	.24	7480	2.50
7431	.24	7481	2.50
7432	.24	7482	2.50
7433	.24	7483	2.50
7434	.24	7484	2.50
7435	.24	7485	2.50
7436	.24	7486	2.50
7437	.24	7487	2.50
7438	.24	7488	2.50
7439	.24	7489	2.50
7440	.24	7490	2.50
7441	.24	7491	2.50
7442	.24	7492	2.50
7443	.24	7493	2.50
7444	.24	7494	2.50
7445	.24	7495	2.50
7446	.24	7496	2.50
7447	.24	7497	2.50
7448	.24	7498	2.50
7449	.24	7499	2.50
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74LS08	.24	74LS133	.80
74LS09	.24	74LS134	.80
74LS10	.24	74LS135	.80
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74LS58	.24	74LS183	.80
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74LS60	.24	74LS185	.80

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74LS81	.24	74LS206	.80
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74LS85	.24	74LS210	.80

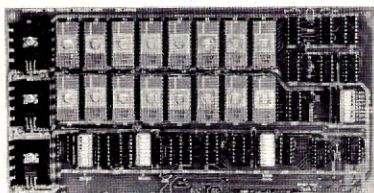
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74LS98	.24	74LS223	.80
74LS99	.24	74LS224	.80
74LS100	.24	74LS225	.80
74LS101	.24	74LS226	.80
74LS102	.24	74LS227	.80
74LS103	.24	74LS228	.80
74LS104	.24	74LS229	.80
74LS105	.24	74LS230	.80
74LS106	.24	74LS231	.80
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74LS116	.24	74LS241	.80
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74LS118	.24	74LS243	.80
74LS119	.24	74LS244	.80
74LS120	.24	74LS245	.80
74LS121	.24	74LS246	.80
74LS122	.24	74LS247	.80
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74LS124	.24	74LS249	.80
74LS125	.24	74LS250	.80

74LS126	.24	74LS251	.80
74LS127	.24	74LS252	.80
74LS128	.24	74LS253	.80
74LS129	.24	74LS254	.80
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32K S-100 EPROM CARD NEW!



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USES 2716's
Blank PC Board - \$34
ASSEMBLED & TESTED
ADD \$30

SPECIAL: 2716 EPROM's (450 NS) Are \$9.95 Ea. With Above Kit.

KIT FEATURES:

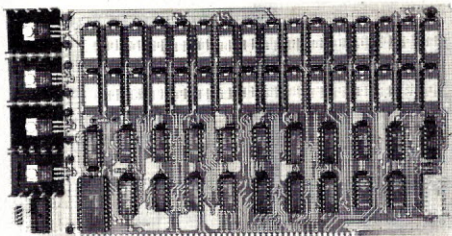
1. Uses +5V only 2716 (2Kx8) EPROM's.
2. Allows up to 32K of software on line!
3. IEEE S-100 Compatible.
4. Addressable as two independent 16K blocks.
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9. Gold plated contact fingers
10. Unselected EPROM's automatically powered down for low power.
11. Fully buffered and bypassed.
12. Easy and quick to assemble.

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PRICE CUT!

\$149.95
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FOR 4MHZ
ADD \$10



KIT FEATURES:

1. Addressable as four separate 4K Blocks.
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4. ON BOARD SELECTABLE WAIT STATES.
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7. Kit includes ALL parts and sockets.
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LOW PROFILE SOCKET SET-\$12

SUPPORT IC'S & CAPS-\$19.95

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KIT FEATURES:

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National Semiconductor 5257. Arranged 4K x 1. +5V, 18 PIN DIP. A Lower Power Replacement for TMS 4044. 450 NS. Several Boards on the way! With Adept 2716 Rams. SUPER SURPLUS PURCHASE! PRIME NEW UNITS!

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64K S100 STATIC RAM

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LOW POWER!

RAM OR EPROM!

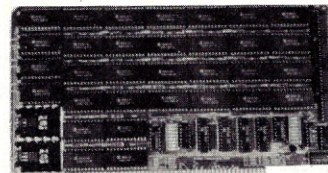
BLANK PC BOARD
WITH DOCUMENTATION
\$55

SUPPORT IC's + CAPS
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FULLY SUPPORTS THE
NEW IEEE 696 S100
STANDARD
(AS PROPOSED)

FOR 56K KIT \$299
ASSEMBLED AND
TESTED ADD \$40



FEATURES:

- * Uses new 2K x 8 (TMM 2016 or HM 6116) RAMs.
- * Fully supports IEEE 696 24 BIT Extended Addressing.
- * 64K draws only approximately 500 MA.
- * 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- * SUPPORTS PHANTOM (BOTH LOWER 32K AND ENTIRE BOARD).
- * 2716 EPROMs may be installed in any of top 48K.
- * Any of the top 8K (E000 H AND ABOVE) may be disabled to provide windows to eliminate any possible conflicts with your system monitor, disk controller, etc.
- * Perfect for small systems since BOTH RAM and EPROM may co-exist on the same board.
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64K SS-50 STATIC RAM

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RAM OR EPROM!

BLANK PC BOARD
WITH
DOCUMENTATION
\$52

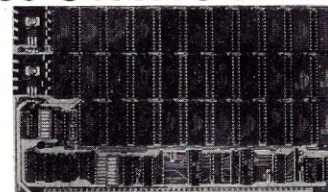
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FULL SOCKET SET
\$15.00

56K Kit \$309

64K Kit \$359

ASSEMBLED AND
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FEATURES:

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- * Fully supports Extended Addressing.
- * 64K draws only approximately 500 MA.
- * 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- * Board is configured as 3-16K blocks and 8-2K blocks (within any 64K block) for maximum flexibility.
- * 2716 EPROMs may be installed anywhere on Board.
- * Top 16K may be disabled in 2K blocks to avoid any I/O conflicts.
- * One Board supports both RAM and EPROM.
- * RAM supports 2MHZ operation at no extra charge!
- * Board may be partially populated in 16K increments.

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UART SALE!

TR1602B - SAME AS TMS6011,
AY5-1013, ETC. 40 PIN DIP

TR1602B

\$2.95
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4 For \$10.00

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SMC #CRT 5037. PROGRAMMABLE FOR 80 x 24, ETC. VERY RARE SURPLUS FIND. WITH PIN OUT. \$12.95 EACH.

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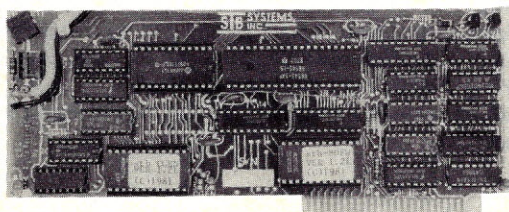
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STB-80™ APPLE VIDEO BOARD



\$259
ASSEMBLED
& TESTED

FEATURES:

- ★ 24 x 80 Display
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- ★ Line Graphics
- ★ Software Screen Switch to Standard Apple
- ★ Emulates all Basic Screen Formatting Commands
- ★ Compatible with PASCAL & CP/M
- ★ Software Controllable Inverse Video by Character & Screen

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#1 DOS TOOL KIT PATCH DISKETTE

This patches the APPLE EDITOR & ASSEMBLER for use with the STB-80.
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#2 APPLE WRITER PATCH DISKETTE

This patches the APPLE WRITER WORD PROCESSOR package for use with the STB-80.
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APPLE MEMORY EXPANSION BOARDS

STB-16™ 16K BOARD

- ★ Assembled & Tested
- ★ Increases 48K to 64K
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16K A & T

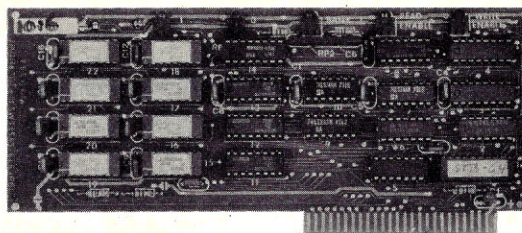
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- ★ Four STB-16's on one Card
- ★ Software Bank Selectable
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- ★ DOS 3.3 Support Disk FREE with Purchase

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128K A & T

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(FREE with STB-64 or STB-128)

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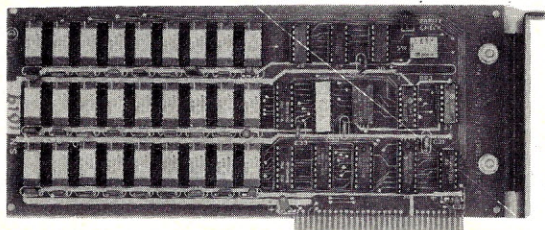
Expands Visicalc 3.3 using our STB 64/128 memory cards. 145K work space using our STB 128 or 85K with our STB 64. Simple one step operation.

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IBM PC MEMORY EXPANSION BOARDS

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64K — \$349 (STB-I164)

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ALL ASSEMBLED & TESTED

EXPANSION KIT TO GO FROM 64K
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- ★ Expand Your IBM to 256K Using Only one Slot.
- ★ Available in 64, 128, or 192K Sizes
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CALENDAR

Computers in Education

The second annual Computers in Education Workshop will be held at Stroudsburg State College, East Stroudsburg, PA, Aug. 9-13.

The workshop is designed for elementary and secondary school teachers and administrators, covering over a dozen topics. The program will present studies in computer literacy, word processing, administrative applications, evaluating computer software, evaluating equipment, writing instructional programs, writing specifications for computers, PILOT, using computers in the classroom, computer graphics, interactive video, computers in music and computers in the sciences and humanities for both elementary and secondary classrooms.

Both undergraduate and graduate credit is available through the workshop.

For further information please contact Dr. Terry C. Giffel, Associate Professor, Department of Educational Communications and Technology, East Stroudsburg State College, East Stroudsburg, PA 18301. 717-424-3737.

Word Processing/Information Systems Expo

The Word Processing/Information Systems Expo, which was scheduled for Sept. 21 and 22, has been rescheduled for fall 1983. The emphasis of the 1983 conference is on increasing productivity through integrated office systems, going steps beyond simple office automation.

For more information or to reserve booth space please call Joseph P. Rubel, National Trade Productions, Inc., 91418 Annapolis Road, Lanham, MD 20706. 301-459-8383.

Business Equipment Show

The 18th Annual Business Equipment Show will be presented by the San Francisco Chapter of the Administrative Management Society on Aug. 17-19. This event will provide an opportunity to review and evaluate new offerings among computers, computer accessories, word processors, office systems, copiers, service and supplies.

For further information contact Emma Lee, AMS-SF Chairman, 900 Chestnut St. #404, San Francisco, CA 94109. 415-776-4875.

Journal of Computers Reading & Language Arts

A new quarterly, *The Journal of Computers Reading & Language Arts* (CRLA), is ready to receive papers. The journal's purpose is to support the rapidly growing interest in computers and their relationship to reading, language arts and related issues. The theme of the journal will be pragmatic in perspective. It will emphasize presenting papers which have clear classroom/teaching implications.

Papers or requests for information should be sent to Gerald H. Block, CRLA, PO Box 13039, Oakland, CA 94661.

PC + 1—An IBM Personal Computer Convention

PC + 1, the annual convention and exhibition sponsored by Personna, the National Association for users of the IBM PC, will be held Sept. 8-11 at the Golden Nugget Hotel-Casino, Atlantic City, NJ. The convention will feature exhibits of products, pro-

grams and games for the IBM Personal Computer user.

For exhibition information contact Atlantic Data Supply Corp., Highway 88, Brick, NJ 08723. 201-840-8778; for Personna membership information contact Personna Computer Association, PO Box 759, Point Pleasant, NJ 08742.

Exhibits are open to the public and cost \$12 if registered or \$15 at the gate.

NJ Microcomputer Show and Flea Market

The NJ Microcomputer Show and Flea Market will be held Sept. 11 and 12 at the Holiday Inn (North), North Passenger Terminal of Newark International Airport, Newark, NJ. This show will include over 50 commercial exhibitors and 250 flea market sellers. Registration is \$5, with no charge for children under 12 years of age.

For additional information contact Kengore Corp., 3001 Rte. 27, Franklin Park, NJ 08823. 201-297-2526.

PerCompAsia 82

The first Southeast Asian personal computer hardware and software show will be held October 20-23 at the Hyatt Convention Center in Singapore.

For further information contact Overseas Exhibition Services Ltd., 11 Manchester Square, London, W1M 5AB, England. Telephone: 01-486 1951, Telex: 24591 Montex.

FLINT Conference

The Goethe Institute, San Francisco, and the Defense Language Institute, Monterey, will co-sponsor the FLINT (Foreign Language Instructional Technology) Conference in Monterey, CA, Sept. 21-24.

This conference will address the application of electronic technology (computer, video and audio systems) for the improvement of foreign language teaching. For information contact Goeth Institute, 530 Bush St., San Francisco, CA 94108. 415-391-0370.

Peripherals '82

The first International Peripheral Equipment and Software Exposition (Peripherals '82) will be held Sept. 29, 30 and Oct. 1 at the Anaheim Convention Center, Anaheim, CA.

For more information on exhibiting or visiting Peripherals '82 contact Cahners Exposition Group, 222 West Adams St., Chicago, IL 60606. 312-263-4866, Telex: 256148.

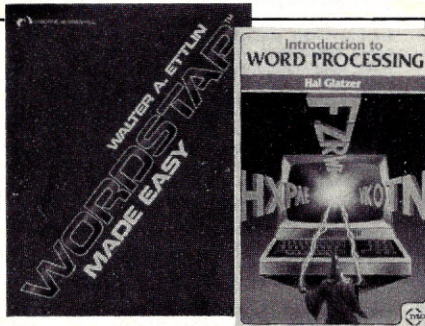
The Fifth Annual Personal Computer World Show

The fifth annual Personal Computer World Show will be held at Barbican Center, London, England, Sept. 9-12, and will include a wide range of exhibits oriented toward the business, scientific, educational and hobbyist markets.

For more information contact Tim Collins, Montbuild Ltd., 11 Manchester Square, London W1M 5AB. Telephone: 01-486 1951, Telex: 24591, Montex G.

Special Interests

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A USER GUIDE TO THE UNIX SYSTEM by Jean Yates and Rebecca Thomas. Here at last is a clearly written book that allows you to use the Unix operating system easily, and at a fraction of the time it previously took. If you're using, evaluating or simply curious about this system, this is your book. BK1242 \$15.99

WORDSTAR MADE EASY by Walter A. Ettlin. Now WordStar is as simple to learn as it is easy to use. This book teaches WordStar in 14 easy lessons, saving hours of hard work. It comes with a convenient pull-out Command Card. BK1239 \$7.95

INTRODUCTION TO WORD PROCESSING by Hal Glatzer. This book explains in plain language what a word processor can do, how to use one, how it improves productivity—especially in businesses that handle lots of words—and how to buy one wisely. No technical knowledge required, for all first-time users and those considering purchasing a word processor. BK1238 \$12.95

THE CUSTOM TRS-80 AND OTHER MYSTERIES—by Dennis Kitz. More than 300 pages of TRS-80 customizing information. With this book you'll be able to explore your computer like never before. Want to turn an 8 track into a mass storage unit? Individual reverse characters? Replace the BASIC ROMs? Make Music? High speed, reverse video, Level I and Level II? Fix it if it breaks down? All this and much, much more. Even if you have never used a soldering iron or read a circuit diagram, this book will teach you how! This is the definitive guide to customizing your 80! BK1218 \$29.95.

BASIC FASTER AND BETTER AND OTHER MYSTERIES—by Lewis Rosenfelder. You don't have to learn assembly language to make your programs run fast. With the dozens of programming tricks and techniques in this book you can sort at high speed, swap screens in the twinkling of an eye, write INKEY routines that people think are in assembly language and add your own commands to BASIC. Find out how to write elegant code that makes your BASIC really hum, and explore the power of USR calls. BK1221 \$29.95.

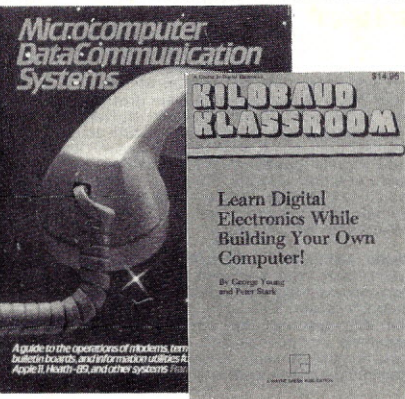
THE CP/M HANDBOOK (with MP/M)—by Rodney Zaks. A complete guide and reference handbook for CP/M—the industry standard in operating systems. Step-by-step instruction for everything from turning on the system and inserting the diskette to correct user discipline and remedial action for problem situations. This also includes a complete discussion of all versions of CP/M up to and including 2.2, MP/M and CDOS. BK1187 \$14.95.

TRS-80 DISK AND OTHER MYSTERIES—by Harvard C. Pennington. This is the definitive work on the TRS-80 disk system. It is full of detailed "How to use," information with examples, samples and in-depth explanations suitable for beginners and professionals alike. The recovery of one lost file is worth the price alone. BK1181 \$22.50.

MICROSOFT BASIC DECODED AND OTHER MYSTERIES—by James Favour. From the company that brought you TRS-80 DISK AND OTHER MYSTERIES. Contains more than 6500 lines of comments for the disassembled Level II ROMs and six additional chapters describing every BASIC subroutine, with assembly language routines showing how to use them. Flowcharts for all major routines give the reader a real insight into how the interpreter works. BK1186 \$29.50.

NEW NEW

Introductory



KILOBAUD KLASROOM—by George Young and Peter Stark. Learning electronics theory without practice isn't easy. And it's no fun to build an electronics project that you can't use. *Kilobaud Klassroom* the popular series first published in *Kilobaud Microcomputing*, combines theory with practice. This is a practical course in digital electronics. It starts out with very simple electronics projects, and by the end of the course you'll construct your own working microcomputer!

Authors Young and Stark are experienced teachers, and their approach is simple and direct. Whether you're learning at home or in the classroom, this book provides you with a solid background in electronics—and you'll own a computer that you built yourself! BK7386 \$14.95

TOOLS & TECHNIQUES FOR ELECTRONICS—by A. A. Wicks. This is an easy-to-understand book written for the beginning kit-builder as well as the experienced hobbyist. It has numerous pictures and descriptions of the safe and correct ways to use basic and specialized tools for electronic projects, as well as specialized metal-working tools and the chemical aids which are used in repair shops. BK7348 \$4.95.

MICROCOMPUTER DATA COMMUNICATIONS SYSTEMS by Frank J. Derfler. This text has a lot of good information on message systems and information utilities; the fundamentals of data communications, modems, terminals, and software for specific microcomputers. Interesting and informative for the beginner, yet a good reference for the experienced data communications user. BK1243 \$12.95

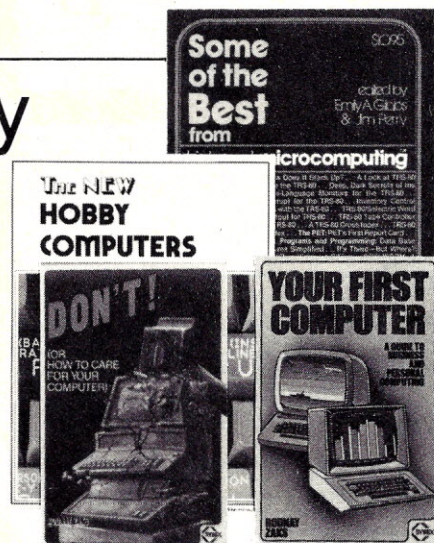
UNDERSTANDING AND PROGRAMMING MICROCOMPUTERS—A valuable addition to your computing library. This two part text includes the best articles that have appeared in 73 and Kilobaud Microcomputing magazines on the hardware and software aspects of microcomputing. Well known authors and well structured text helps the reader get involved. BK7382 \$10.95.

SOME OF THE BEST FROM KILOBAUD/MICROCOMPUTING—A collection of the best articles that have recently appeared in *Kilobaud/MICROCOMPUTING*. Included is material on the TRS-80 and PET systems, CP/M, the 8080/8085/Z80 chips, the ASR-33 terminal. Data base management, word processing, text editors and file structures are covered too. Programming techniques and hardware construction projects for modems, high speed cassette interfaces and TVTs are also included in this large format, 200 plus page edition. BK7311 \$10.95.

DON'T (or How to Care for Your Computer)—by Rodney Zaks. In plain language, with numerous illustrations, this book tells all the do's and don't's of the care, preservation and correct operation of the small computer system. Specific chapters cover each piece of hardware and software, as well as safety and security precautions and help for problem situations. Have your computer work right the first time and keep it working. No technical background required. For all computer users. BK1237 \$11.95.

YOUR FIRST COMPUTER—by Rodney Zaks. Whether you are using a computer, thinking about using one or considering purchasing one, this book is indispensable. It explains what a computer system is, what it can do, how it works and how to select various components and peripheral units. It is written in everyday language and contains invaluable information for the novice and the experienced programmer. (The first edition of this book was published under the title "An Introduction to Personal and Business Computing") BK1191 \$8.95.

MICROPROCESSOR INTERFACING TECHNIQUES—by Austin Lessee & Rodney Zaks—will teach you how to interconnect a complete system and interface it to all the usual peripherals. It covers hardware and software skills and techniques, including the use and design of model buses such as the IEEE 488 or S-100. BK1037 \$17.95.



AN INTRODUCTION TO MICROCOMPUTERS, VOL. 1—2nd Edition completely revised. Dedicated to the basic concepts of microcomputers and hardware theory. The purpose of Volume I is to give you a thorough understanding of what microcomputers are. From basic concepts (which are covered in detail), Volume I builds the necessary components of a microcomputer system. This book highlights the difference between minicomputers and microcomputers. BK1030 \$12.99.

THE NEW HOBBY COMPUTERS—This book takes it from where *Hobby Computers Are Here!* leaves off, with chapters on Large-Scale Integration, how to choose a microprocessor chip, an introduction to programming, low-cost I/O for a computer, computer arithmetic, checking memory boards... and much, much more! Don't miss this tremendous value! BK7340 \$4.95.

AN INTRODUCTION TO MICROCOMPUTERS, VOL. 0—The Beginner's Book—Written for readers who know nothing about computers—for those who have an interest in how to use computers—and for everyone else who must live with computers and should know a little about them. The first in a series of 4 volumes, this book will explain how computers work and what they can do. Computers have become an integral part of life and society. During any given day you are affected by computers, so start learning more about them with Volume 0. BK1130 \$7.95.

HOBBY COMPUTERS ARE HERE!—If you want to come up to speed on how computers work—hardware and software—this is an excellent book. It starts with fundamentals and explains the circuits and the basics of programming, along with a couple of TVT construction projects, ASCII, Baudot, etc. This book has the highest recommendations as a teaching aid. BK7322 \$4.95.

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Microcomputing, August 1982 135

Programming



Z-80

6502

68000/6809

TRS-80 ASSEMBLY LANGUAGE—by Hubert S. Howe, Jr. This book incorporates into a single volume all the pertinent facts and information you need to know to program and enjoy the TRS-80. Included are clear presentations of all introductory concepts, completely tested practical programs and subroutines, details of ROM and RAM and disk operating systems, plus comprehensive tables, charts and appendices. Suitable for the first time user or more experienced users. BK1217 \$9.95.*

INSIDE LEVEL II—For machine language programmers. This is a comprehensive reference guide to the Level II ROMs, allowing easy utilization of the sophisticated routines they contain. It concisely explains set-ups, calling sequences, variable passage and I/O routines. Part II presents an entirely new composite program structure which unloads under the SYSTEM command and executes in both BASIC and machine code with the speed and efficiency of a compiler. Special consideration is given to disk systems. BK1183 \$15.95.*

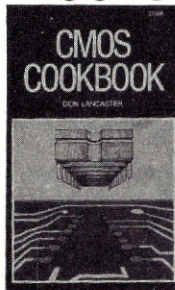
PROGRAMMING THE Z-80—by Rodney Zaks. Here is assembly language programming for the Z-80 presented as a progressive, step-by-step course. This book is both an educational text and a self-contained reference book, useful to both the beginning and the experienced programmer who wish to learn about the Z-80. Exercises to test the reader are included. BK1122 \$15.95.*

Z-80 ASSEMBLY LANGUAGE PROGRAMMING—by Lance A. Leventhal. This book thoroughly covers the Z-80 instruction set, abounding in simple programming examples illustrating software development concepts and actual assembly language usage. Features include Z-80 I/O devices and interfacing methods, assembler conventions, and comparisons with 8080A/8085 instruction sets and interrupt structure. BK1177 \$16.99.*

PROGRAMMING THE 6502 (Third Edition)—Rodney Zaks has designed a self-contained text to learn programming, using the 6502. It can be used by a person who has never programmed before, and should be of value to anyone using the 6502. The many exercises will allow you to test yourself and practice the concepts presented. \$13.95.* BK1005

6502 APPLICATIONS BOOK—Rodney Zaks presents practical application techniques for the 6502 microprocessor, assuming an elementary knowledge of microprocessor programming. You will build and design your own domestic-use systems and peripherals. Self-test exercises included. BK1006 \$12.95.*

Cook Books



CMOS COOKBOOK—by Don Lancaster. Details the application of CMOS, the low power logic family suitable for most applications presently dominated by TTL. Required reading for every serious digital experimenter! BK1011 \$10.50.*

TTL COOKBOOK—by Don Lancaster. Explains what TTL is, how it works, and how to use it. Discusses practical applications, such as a digital counter and display system, events counter, electronic stopwatch, digital voltmeter and a digital tachometer. BK1063 \$9.50.*

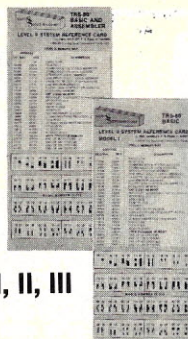
TVT COOKBOOK—by Don Lancaster. Describes the use of a standard television receiver as a microprocessor CRT terminal. Explains and describes character generation, cursor control and interface information in typical, easy-to-understand Lancaster style. BK1064 \$9.95.*

NANOS SYSTEM REFERENCE

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Model III: BASIC only FC1004	3.95
Model III: BASIC and Assembler FC1003	5.95
APPLE II: BASIC only FC1007	3.95
APPLE II: BASIC + 6502 FC1008	4.95

PET/CBM PERSONAL COMPUTER GUIDE—by Adam Osborne and Carol Donahue. **REVISED SECOND EDITION** This is the book that will show you what the Commodore PET or CBM can do and how to get your's up and running. Designed as a self-teaching BASIC tutorial, the book will teach you both BASIC and CBM BASIC, yet it assumes no knowledge of computers or programming. Included are: complete operating instructions, Description of all PET/CBM BASIC statements, optimal programming techniques and solutions to many programming problems. BK1231 \$15.00

SOME COMMON BASIC PROGRAMS, APPLE II EDITION—by Lon Poole et al. A powerful collection of financial, statistical, home management and mathematics programs—76 in all—Each program is presented with BASIC source code, operating instructions and descriptions. If you're a beginning programmer you can learn from this book what well designed and documented programs look like. BK1232 \$14.95

UNDERSTANDING YOUR VIC VOL. 1: BASIC PROGRAMMING—by David Schultz. For the beginning VIC programmer—this book is full of examples and exercises (with expected results included as immediate feedback) that will help you to quickly and easily learn about the VIC. Included are chapters on program design with the use of pseudo code and data dictionaries to refine programming problems, and on VIC color and sound features. A fine learn-by-doing programming guide. BK1234 \$11.95.

6502 ASSEMBLY LANGUAGE PROGRAMMING—by Lance A. Leventhal. This book provides comprehensive coverage of the 6502 microprocessor assembly language. Leventhal covers over 80 programming examples from simple memory load loops to complete design projects. Features include 6502 assembler conventions, input/output devices and interfacing methods and programming the 6502 interrupt system. BK1176 \$16.99.*

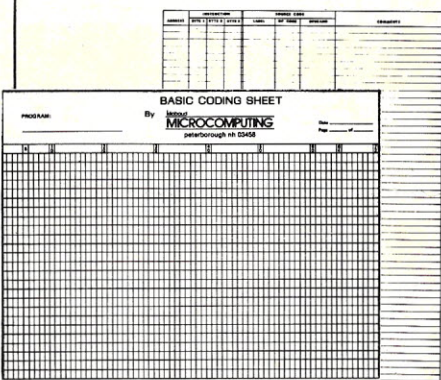
THE APPLE II USER'S GUIDE—by Lon Poole, Martin McNiff, and Steven Cook. This guide is the key to unlocking the full power of your Apple II or Apple II Plus. Topics include: "Applesoft and Integer BASIC Programming"—especially how to make the best use of Apple's sound, color and graphics capabilities. "Machine Level Programming." "Hardware Features"—which covers the disk drive and printer, and "Advanced Programming"—describing high resolution graphics techniques and other advanced applications. Well organized and easy to use. BK1220 \$15.00.*

6809 MICROCOMPUTER PROGRAMMING AND INTERFACING—by Andrew C. Staugaard, Jr. Getting involved with Tandy's new Color Computer? If so, this new book from the Blacksburg Group will allow you to exploit the awesome power of the machine's 6809 microprocessor. Detailed information on processor architecture, addressing modes, register operation, data movement, arithmetic logic operations, I/O and interfacing is provided, as well as a review section at the end of each chapter. Four appendices are included covering the 6809 instruction set, specification sheets of the 6809 family of processors, other 6800 series equipment and the 6809/6821 Peripheral Interface Adapter. This book is a must for the serious Color Computer owner. BK1215 \$13.95.*

68000 MICROPROCESSOR HANDBOOK—by Gerry Kane. Whether you're currently using the 68000, planning to use it, or simply curious about one of the newest and most powerful microprocessors, this handbook has all the answers. A clear presentation of signal conversions, timing diagram conventions, functional logic, three different instruction set tables, exception processing, and family support devices provides more information about the 68000 than the manufacturer's data sheets. A stand alone reference book which can also be used as a supplement to *An Introduction to Microcomputers: Vol. 2—Some Real Microprocessors*. BK1216 \$6.99.*

68000 ASSEMBLY LANGUAGE PROGRAMMING—by Gerry Kane, et al. A straightforward self teaching text book on assembly language programming for the 68000 microprocessor. This book contains the entire instruction set, describes the function of assemblers and assembly instructions and discusses basic software development concepts. A large number of practical programming examples are included. BK1233 \$16.99

MICROCOMPUTING CODING SHEETS Microcomputing's dozen or so programmers wouldn't try to work without these handy scratch pads, which help prevent the little errors that can cost hours and hours of programming time. Available for programming in Assembly/Machine Language (PD1001), which has columns for address, instruction (3 bytes), source code (label, op code, operand) and comments; and for BASIC (PD1002) which is 72 columns wide, 50 sheets to a pad. \$2.39.*



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Basic & Pascal

INTRODUCTION TO TRS-80 LEVEL II BASIC AND COMPUTER PROGRAMMING—by Michael P. Zabinski. Written by an experienced educator, this is the book for those beginners who want to learn about computers without having to become an expert. It has practical programs, useful line-by-line comments, excellent flowcharts accompanied by line numbers and over 200 exercises which help the reader assess progress, reinforce comprehension, and provide valuable practical experience. BK1219 \$10.95.*

LEARNING TRS-80 BASIC—by David A. Lien, Dr. Lien, who is the author of *THE BASIC HANDBOOK* and the original *Radio Shack LEVEL I USER'S MANUAL*, has compiled a tutorial which includes portions of the original *USER'S MANUAL*, and most of *LEARNING LEVEL II* along with extensive additions. It will completely cover the TRS-80 Models I, II, III, and 16 (sorry, not the color or pocket computers). It is, of course, written in the easy learning style which readers of Dr. Lien's books have come to enjoy. BK1175 \$19.95.

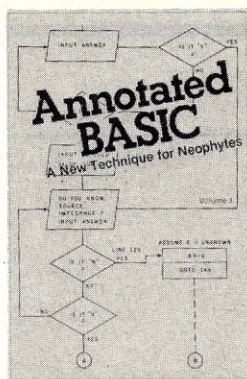
THE BASIC HANDBOOK—SECOND EDITION—by David Lien. This book is unique. It is a virtual *ENCYCLOPEDIA OF BASIC*. While not favoring one computer over another, it explains over 250 BASIC words, how to use them and alternate strategies. If a computer does not possess the capabilities of a needed or specified word, there are often ways to accomplish the same function by using another word or combination of words. That's where the *HANDBOOK* comes in. It helps you get the most from your computer, be it a "bottom-of-the-line" micro or an oversized monster. BK1174 \$19.95.*

BASIC BASIC (2ND EDITION)—by James S. Coan. This is a textbook which incorporates the learning of computer programming using the BASIC language with the teaching of mathematics. Over 100 sample programs illustrate the techniques of the BASIC language and every section is followed by practical problems. This second edition covers character string handling and the use of data files. BK1026 \$10.50.*

ADVANCED BASIC—Applications including strings and files, coordinate geometry, area, sequences and series, simulation and graphing and games. BK1000 \$10.75.*

INTRODUCTION TO PASCAL—by Rodney Zaks. A step-by-step introduction for anyone wanting to learn the language quickly and completely. Each concept is explained simply and in a logical order. All features of the language are presented in a clear, easy-to-understand format with exercises to test the reader at the end of each chapter. It describes both standard PASCAL and UCSD PASCAL—the most widely used dialect for small computers. No computer or programming experience is necessary. BK1189 \$14.95.*

PROGRAMMING IN PASCAL—by Peter Grogono. The computer programming language PASCAL was the first language to embody in a coherent way the concepts of structured programming, which has been defined by Edsger Dijkstra and C.A.R. Hoare. As such, it is a landmark in the development of programming languages. PASCAL was developed by Niklaus Wirth in Zurich; it is derived from the language ALGOL 60 but is more powerful and easier to use. PASCAL is now widely accepted as a useful language that can be efficiently implemented, and as an excellent teaching tool. It does not assume knowledge of any other programming language and therefore suitable for an introductory course. BK1140 \$12.95.*



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ANNOTATED BASIC—A NEW TECHNIQUE FOR NEOPHYTES—BASIC programming was supposed to be simple—a beginner's programming language which was so near to English that it could be easily understood. But, in recent years, BASIC has become much more powerful and therefore much more difficult to read and understand. BASIC simply isn't basic anymore.

Annotated BASIC explains the complexities of modern BASIC. It includes complete TRS-80[®] Level II BASIC programs that you can use. Each program is annotated to explain in step-by-step fashion the workings of the program. Programs are flowcharted to assist you in following the operational sequence. And—each chapter includes a description of the new concepts which have been introduced.

Annotated BASIC deals with the hows and whys of TRS-80 BASIC programming. How is a program put together? Why is it written that way? By observing the programs and following the annotation, you can develop new techniques to use in your own programs—or modify commercial programs for your specific use. *Annotated BASIC Volume 1* BK7384 \$10.95
Annotated BASIC Volume 2 BK7385 \$10.95
Order Both Volumes and Save! BK738402 \$18.95



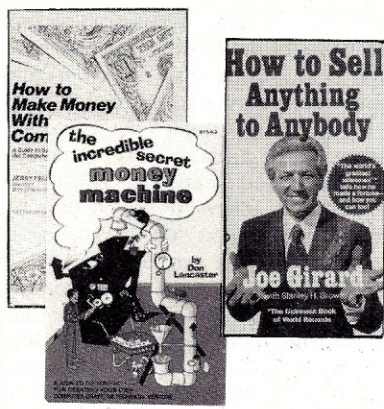
50 BASIC EXERCISES—by J. P. Lamoitier. This book is structured around the idea that the best way to learn a language is through actual practice. It contains 50 completely explained exercises: statement and analysis of the problem, flowcharts, programs and actual runs. Program subjects include mathematics, business, games, and operations research, and are presented in varying levels of difficulty. This format enables anyone to learn BASIC rapidly, checking their progress at each step. BK1192 \$12.95.*

Money making

HOW TO MAKE MONEY WITH COMPUTERS—In 10 information-packed chapters, Jerry Felsen describes more than 30 computer-related, money-making, high profit, low capital investment opportunities. BK1003 \$15.00.*

HOW TO SELL ANYTHING TO ANYBODY—According to *The Guinness Book of World Records*, the author, Joe Girard, is "the world's greatest salesman." This book reveals how he made a fortune—and how you can, too. BK7306 \$2.25.*

THE INCREDIBLE SECRET MONEY MACHINE—by Don Lancaster. A different kind of "cookbook" from Don Lancaster. Want to slash taxes? Get free vacations? Win at investments? Make money from something that you like to do? You'll find this book essential to give you the key insider details of what is really involved in starting up your own money machine. BK1178 \$5.95.*



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Business

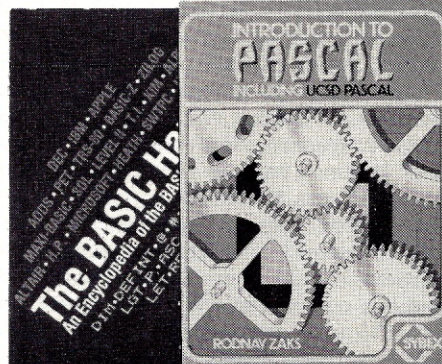
THEORY Z—How American Business Can Meet the Japanese Challenge—by William Ouchi. Why are the Japanese catching up and surpassing American industrial productivity? What allows Japanese industrialists to offer guaranteed lifetime employment to their workforce? This book will help you understand the Theory Z managerial philosophy and its implications for the American corporate future. Examples are given of the American industrial giants already operating under Z-style management, and the impact of this style on the quality of their executives and workers is explored. A must for the alert businessman, large or small. BK1226 \$12.95.*

SO YOU ARE THINKING ABOUT A SMALL BUSINESS COMPUTER—by Richard G. Canning and Nancy C. Leeper. For a well-organized manual on the process of selecting the right computer system for your small business, this text can't be excelled. Designed to introduce the novice in data and word processing to the real benefits of computerization, the book is filled with money- and time-saving tips, photos of equipment, lists of suppliers, prices, explanations of computer terminology, and helpful references to additional sources of information. Everyone contemplating a first computer installation should have this book. BK1222 \$14.00.*

PAYROLL WITH COST ACCOUNTING—IN BASIC—by L. Poole & M. Borchers, includes program listings with remarks, descriptions, discussions of the principle behind each program, file layouts, and a complete user's manual with step-by-step instructions, flowcharts, and simple reports and CRT displays. Payroll and cost accounting features include separate payrolls for up to 10 companies, time-tested interactive data entry, easy correction of data entry errors, job costing (labor of distribution), check printing with full deduction and pay detail, and 16 different printed reports, including W-2 and 941 (in CBASIC). BK1001 \$20.00.*

SOME COMMON BASIC PROGRAMS—Published by Adam Osborne & Associates, Inc. Perfect for non-technical computerists requiring ready-to-use programs. Business programs, plus miscellaneous programs. Invaluable for the user who is not an experienced programmer. All will operate in the stand-alone mode. BK1053 \$14.99

PIMS: PERSONAL INFORMATION MANAGEMENT SYSTEM—Learn how to unleash the power of a personal computer for your own benefit in this ready-to-use data-base management program. BK1009 \$11.95.*



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WHAT'S NEW, BIG BLUE?

No Job Too Big

Software Sampler

A wide variety of software packages for the IBM PC are being developed and marketed these days. Starting things off is a package called Personal Computer Home Management System (PCHMS) by Arlington Software + Systems. PCHMS manages a myriad of personal, household and business details such as organizing and maintaining addresses, phone numbers, home inventory, credit cards, medical and dental records, insurance policies and other useful information. In addition you can define up to ten files for your own needs. PCHMS costs \$89.95 and is available from Arlington Software + Systems, 97 Bartlett Ave., Arlington, MA 02174. Reader Service number 447.

Basic Business Software, Inc. (PO Box 26311, Las Vegas, NV 89126) is offering a package called Statistical Analysis. This package contains 24 statistical programs in the areas of regressions, distributions, hypothesis testing and probability. The price is \$75 and includes a user's manual and five-inch disk. Reader Service number 448.

Lifeboat Associates has announced a new software package for the IBM PC. The Emulator/86 is a CP/M emulator that lets you run software written for CP/M-86 on the IBM PC with DOS. It allows you to run CP/M programs more quickly with faster program loading than with CP/M-86. Emulator/86 is \$75. Lifeboat Associates, 1651 Third Ave., New York, NY 10028. Reader Service number 449.

Business Software

Four new products from VisiCorp's popular VisiSeries software are now available for the IBM PC: VisiFile, Visi-Trend/Plot, VisiDex and Desktop/PLAN. Each of the programs has been customized to take advantage of the IBM PC features such as 80-character display, high-resolution graphics, and full key-

board and function keys. VisiFile, Visi-Trend/Plot and Desktop/PLAN are \$300 each; VisiDex is \$250. VisiCorp, 2895 Zanker Road, San Jose, CA 95134. Reader Service number 453.

MAIL-XI is an advanced mailing list system from Micro Architect, Inc. (96 Dothan St., Arlington, MA 02174) that requires a dual disk system with 64K memory and IBM DOS, monochrome display and a printer. The price is \$288. Reader Service number 454.

High Technology Software has released three software packages. Job Control System is for small to medium size companies in manufacturing, construction or service industries and provides reports showing job status and the real costs of producing a product or providing a service. Price is \$750. PACE (Prompt Accurate Cost Estimator) is a general estimating product suitable for any repetitive unit cost estimating. Price is \$395. Gusher is a program designed to handle the accounting needs of oil and gas well operators. Price is \$995. Contact High Technology Software Products, Inc., PO Box 14665, 2201 N.E. 63 St., Oklahoma City, OK 73113. Reader Service number 455.

Accounting Plus, from Professional Micro Systems, is an accounting package for the IBM PC running under CP/M-86. The package includes an integrated order entry, inventory control, sales analysis, purchase order, accounts payable, accounts receivable, payroll and general ledger. This software requires Professional Micro Systems' 20 megabyte hard disk for the IBM PC. Accounting Plus and the disk subsystems are available from Professional Micro Systems, Inc., Suite 3000, 4000 MacArthur Blvd., Newport Beach, CA 92660. Reader Service number 456.

S.S.R. Corp. (1600 Lyell Ave., Rochester, NY 14606) is now offering INFOTORY, an inventory management system for the IBM PC. INFOTORY accommodates 2600 inventory items on a two-drive system and has the capability of

Wildcatters, Accountants Reach for PC

expanding an additional 1300 items for each drive that's added. INFOTORY requires 64K, two disk drives and a 132-character printer. Price is \$425. Reader Service number 457.

Communications Software

Move-It is a communications program for both IBM PC-DOS and CP/M-86 that allows you to transfer files between IBM PCs. In addition, you can transfer files between your IBM PC and any other computer that uses CP/M, MP/M, CP/M-86 and MP/M-86 even if the computers use different disk formats. Move-It can transfer all data types over standard phone and RS-232 lines. Since the program doesn't require an operator at the remote computer, data can be transferred at any time. Move-It is available from Woolf Software Systems, 23842 Archwood St., Canoga Park, CA 91307; price is \$150. Reader Service number 450.

Word Processing

Micro Architect has released a text processing program, Word-II. It accepts lines of text interspersed with lines of format control information and formats the text into a document. Besides the basic formatting commands, it also includes many advanced features. Word-II is available from Micro Architect, Inc., 96 Dothan St., Arlington, MA 02174; cost is \$88. Reader Service number 451.

Volkswriter is a word processor designed specifically for the IBM PC by Lifetree Software, Inc. Volkswriter is self-teaching and was designed to be fast and easy to use. Volkswriter is written in Pascal and requires 64K memory. For extensive writing, 128K memory is recommended. Cost is \$195 from Lifetree Software, Inc., 177 Webster St., Suite 342, Monterey, CA 93940. Reader Service number 452.



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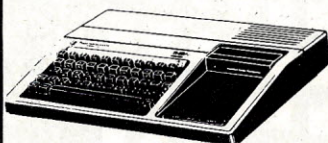
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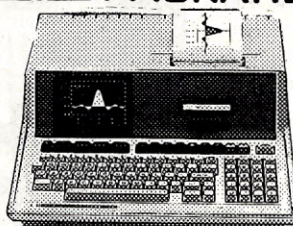
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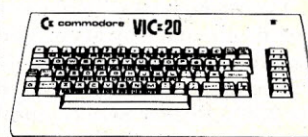


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Memory Expansion Boards

Expansion memory boards for the IBM PC abound this month. Microsoft is offering an expandable plug-in memory system called RAMCard. RAMCard includes a board with up to 256K of RAM, a disk that enables the computer to use some or all of the memory as RAMDrive for disk I/O, and a manual. RAMCard is available in 64, 128, 192 and 256K configurations priced from \$495 to \$1095. A 64K upgrade kit is \$200. Reader Service number 440.

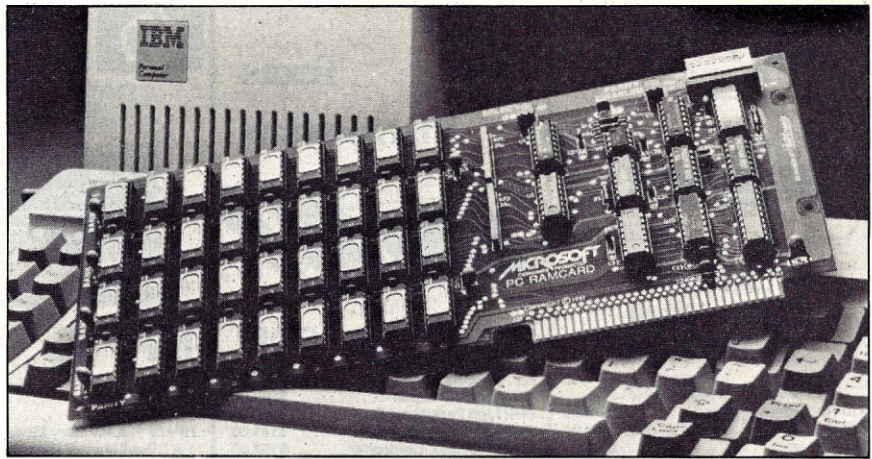
Persyst, Inc. (Personal Systems Technology, Inc., 22957 La Cadena, Laguna Hills, CA 92653) also makes memory expansion boards for the IBM PC ranging from 64 to 256K. They range in price from \$395 for 64K to \$1075 for 256K. Their 64K expansion kit is \$225. Reader Service number 441.

Maxi-RAM is available from Memory Technologies, Inc., Box 6, Twelve Mile, IN 46988. Maxi-RAM is a memory expansion board with up to 512K of RAM. The 512K version costs \$1295; the 192K board costs \$779 and the 64K board is \$549. 64K chip sets are \$125. Reader Service number 442.

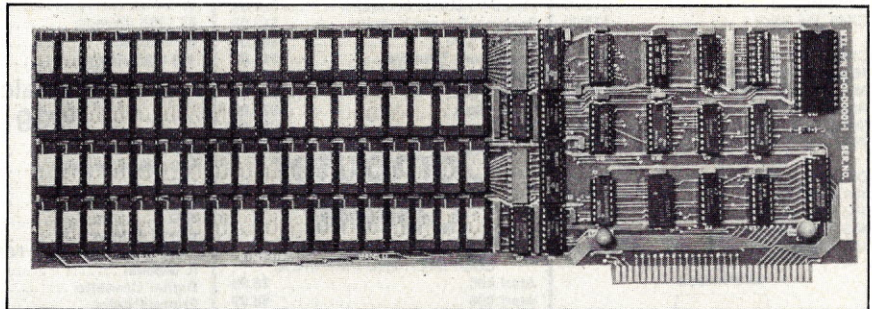
The MM64 series of memory expansion boards are made by Micro Match, 10343 Commerce Ave., Tujunga, CA 91042. Prices range from \$400 for 64K to \$730 for 256K. Reader Service number 443.

More Hardware

Omni-board from Automated Business Machines, Inc. has space for up to five adapters allowing for the configuration of a fully featured IBM PC without an expansion chassis. Two IBM compatible RS-232 asynchronous communication ports provide for the attachment of printers and plotters while maintaining a telephone link with another computer. The printer and game adapters are compatible with IBM software. A clock/calendar with rechargeable battery backup is also available with Omni-board. Omni-board



The RAMCard from Microsoft.



Maxi-RAM expansion board from Memory Technologies, Inc.

can be configured with any of these features. Prices range from \$165 for a printer adapter to \$485 for a fully configured board. Automated Business Machines, Inc., 29352 Avocet Lane, South Laguna, CA 92677. Reader Service number 444.

Speech Synthesis

The V100 Interactive Voice Synthesizer is plug-in compatible with the IBM PC and allows direct connection to the telephone line. The V100 can dial, answer and detect touch-tone signals generated by a remote user and can respond

with information derived from a program or local database. The V100 costs \$450 and is available from Vynet Corp., 2405 Qume Drive, San Jose, CA 95131. Reader Service number 445.

From Big Blue

IBM is now offering the 320KB Diskette Drive which accommodates up to 327,680 characters of programs and data on 5¼-inch disks, doubling the amount of disk storage previously available. The drive is \$650. Contact IBM, System Products Division, Entry Systems, PO Box 1328, Boca Raton, FL 33432. Reader Service number 446.

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MICRO QUIZ

(from page 8)

Answer: - 11


Since the accumulator is - 1 after the subtract, the branch to ELSE is taken. X is loaded, Y is added twice, and the result is stored in TMP. The corresponding high-level code is:

ACC = 2X - 3Y

if ACC = 0 then ACC = ACC + 3Y
else ACC = X + 2Y

TMP = ACC

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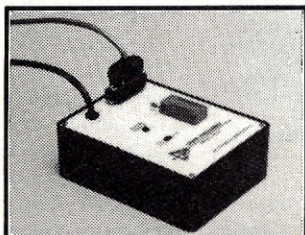
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Wang Laboratories, Inc., 1 Industrial Ave., Lowell, MA 01851. Reader Service number 477.



Wang's Professional Computer features a detached keyboard.

prepare vocabularies consisting of phonemes, words or phrases for speech output

purposes. Mimitalk costs \$34.95. Reader Service number 469.

Speak to Your Apple

Speech processing for Apple computers is available from Mimic, Inc., PO Box 921, Acton, MA 01720. Versions range from bare boards for user assembly (under \$20) to a complete plug-in version (under \$200). Applications include games, aids for the handicapped, tuning or practice aids for musicians and voice alarms. All Mimic systems are based on digital recording and reproduction of voice signals, and provide intelligible, communication-quality speech.

Mimic also offers Mimitalk software, which lets the user



This Mimic speech processor plugs into your Apple computer to provide voice capability.

Inexpensive Modem

A direct-connect, 300 bps modem is available from Inmac, Department 50, 2465 Augustine Drive, Santa Clara, CA 95051. The modem, designed for full duplex, asynchronous data communication, plugs directly into existing phone lines. It features automatic switching between answer and originate modes, self-diagnostics, a carrier-detect LED that indicates contact, and push-button control for voice or data transmission. It is priced under \$200. Reader Service number 465.

Voice Synthesis

The Intex-Talker is a high-fidelity text-to-speech synthesizer, available as a stand-alone module or board for all popular microcomputers. It provides a real-time audio interface for data processing, telecommunications, automation, education and handi-



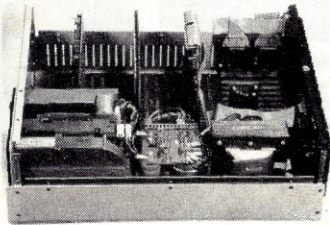
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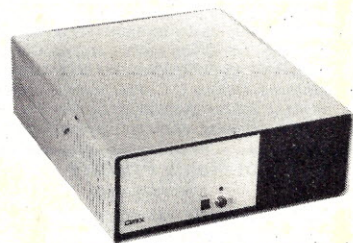
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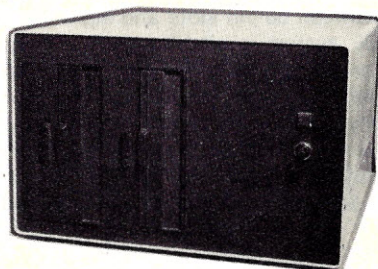
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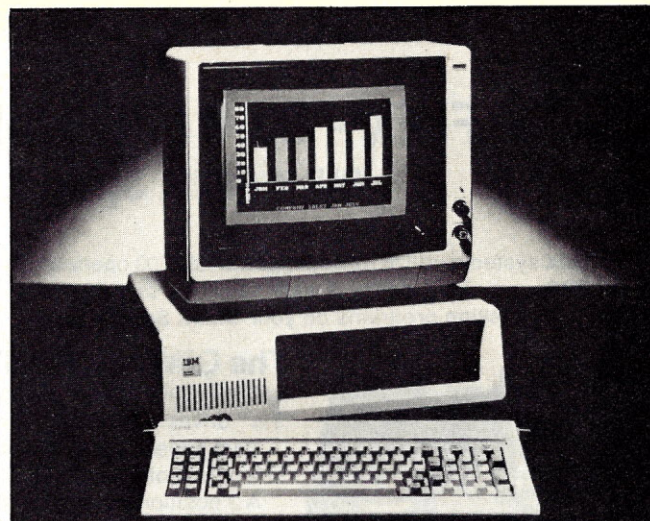
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Amdek's Color II monitor offers high-resolution color graphics for IBM PC and Apple computers.

capped markets. It can enunciate data transmitted at high speed over telephone lines or serve as an unlimited vocabulary audio interface for telephone transactions. Intex-Talker enables blind people to type accurately, and functions as a communicator for the vocally impaired. The unit can echo each typed character or pronounce complete words. Intex-Talker is priced at \$295.

Intex Micro Systems Corp., 4758 Brafferton, Bloomfield Hills, MI 48013. Reader Service number 470.

twice the resolution of a conventional television set. It features 16-color intensity modulation when used with the IBM Personal Computer, with which it is plug-in compatible. The Color II monitor costs \$899.

To interface the Color II with an Apple II computer, Amdek supplies a Digital Video Multiplexer; price of the DVM interface is \$199. Reader Service number 479.

Business Graphics Computer

A color graphics computer for the office has been introduced by the Sony Corporation of America, 9 West 57th St., New York, NY 10019. The SMC-70 is a 64K machine with an additional

Hires Color Monitor

The Color II monitor from Amdek Corp., 2420 E. Oakton St., Suite E, Arlington Heights, IL 60005, offers



Sony's SMC-70 microcomputer with two 3 1/2-inch floppy disk drives and expansion modules. The computer features high-resolution color graphics.



The Victor 9000 16-bit microcomputer system.

38K of graphics memory; it runs CP/M operating system. It can be expanded to 256K bytes of user memory, and a 16-bit adapter unit is available. The basic computer includes interfaces for a full range of peripherals.

Optional 3½-inch floppy drives can be added for 280K bytes storage per drive. A 256K cache memory device is also available—according to Sony this device appears to the system like a standard disk storage unit, but it operates with extremely high data exchange rates. The computer is compatible with a Sony color monitor, a green-screen monitor or a standard color television set. The system also supports modems for telecommunications. The price of the basic unit is \$1475. Reader Service number 472.

Victor Enters 16-Bit Market

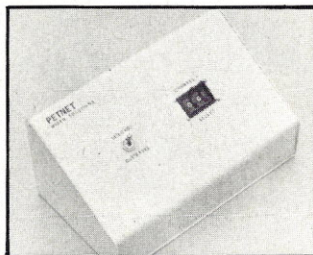
The Victor 9000, based on the 16-bit Intel 8088 microprocessor, features 128K bytes of user memory, expandable to 896K. The system includes two floppy disk drives, and 80/132-column display with graphics-quality resolution and

three I/O ports (two serial and one parallel). Both CP/M-86 and MSDOS operating systems are included. The price is under \$5000.

Victor Business Products, 3900 North Rockwell St., Chicago, IL 60618. Reader Service number 476.

PET Networking

The PETNET controller is compatible with all Commodore PET computers, including the VIC 20. It provides essentially the same capabilities as the Commodore cassette recorder, which it replaces. However, instead of storing information on cassettes, you can use the PETNET to retrieve and store programs from the PET master computer. The master and



The PETNET, from Micro Solutions, controls a network of 16 PET computers.

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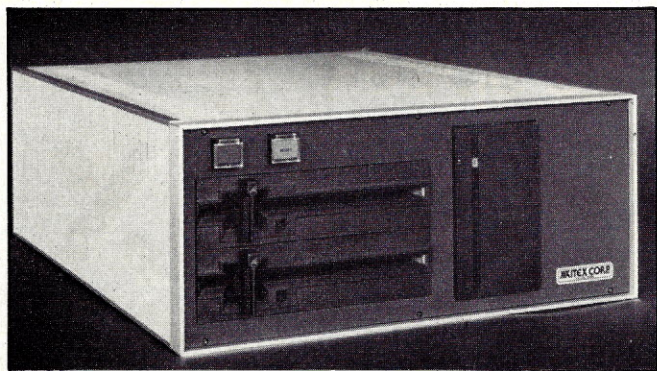
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The XM850S microcomputer from the Xitex Corp. features dual eight-inch floppies and optional hard disk.

its associated disk drives store programs or data for all computers on the network. All computer stations can be simultaneously loaded from the master. The PETNET costs \$695; no supporting software is needed.

Micro Solutions, PO Box 25291, Tempe, AZ 85282. Reader Service number 480.

New 16-Bit Advantage

The Advantage 8/16 computer, from North Star Computers, Inc., 14440 Catalina St., San Leandro, CA 94577, includes an Intel 8088 16-bit microprocessor and an eight-bit Z-80. The new system supports standard North Star operating systems, Graphics CP/M, GDOS/Basic and North Star ASP, plus the 16-bit MSDOS (PCDOS) and future options such as CP/M-86. The

Advantage 8/16 system with dual floppy drives costs \$4099; with 5M-byte hard disk and one floppy, the price is \$5499. A board-level upgrade pack for owners of the original Advantage costs \$499. Reader Service number 475.

Multiuser Micro Runs CP/M

The XM850S STD bus-based microcomputer features dual eight-inch drives and optional five-inch Winchester or floppy disk. It provides 64K bytes of usable memory. The computer is based on a Z-80 CPU and runs CP/M 2.2 operating system. Two serial ports are standard. Addition of Multi/OS software can be factory or field configured. The basic unit sells for \$4799.

Xitex Corporation, 9861 Chartwell Drive, Dallas TX



North Star Advantage 8/16 microcomputer with graphics capability.



The Datavue 132-C video terminal displays 132 columns of data.

75243. Reader Service number 481.

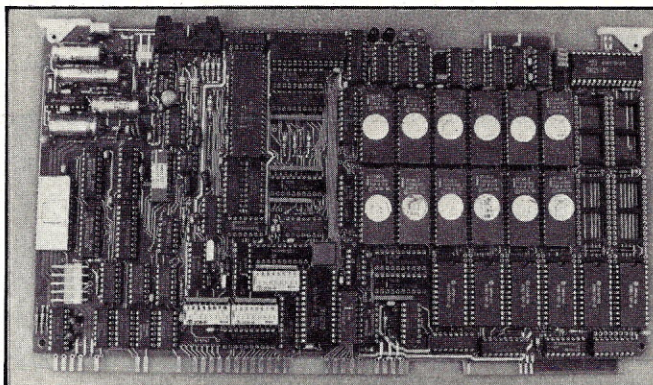
Wide-View Terminal

With more and more computer owners using their equipment for financial spreadsheets and modeling programs, Datavue Corp., 1911 22nd Ave. S., Seattle, WA 98144, offers a wide-screen video terminal that's ideal for these applications. The Datavue 132-C features a 132-column format, which permits display of 12 calendar months of data along with totals and description columns on one screen. The screen is green phosphor, non-glare glass; the keyboard is detached for operator comfort. The Datavue 132-C includes a Z-80 microprocessor that can store five pages of data. The terminal costs \$1995. Reader Service number 473.

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The Prose 2000 text-to-speech converter features an unlimited English vocabulary, and provides clearly enunciated speech output. Telesensory's synthesis-by-rule firmware allows words and sentences to be spoken with humanlike intonation, permitting unlimited applications in business and education. The Prose 2000 recognizes about 60 common abbreviations, and handles certain ambiguities by contextual analysis.

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The Prose 2000 text-to-speech converter from Telesensory Speech Systems.

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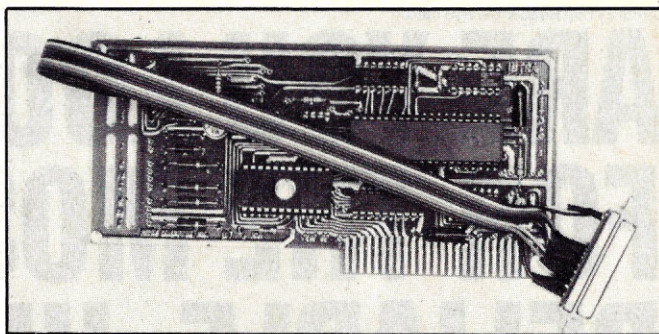
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Intra Computer's Programmable Serial I/O board for Apple computers.

are inappropriate or insufficient (e.g., personal names, user-defined mnemonics). Because the acoustic characteristics of phonemes can vary, dependent on adjacent phonemes, allophonic assignment refines pronunciation.

For a demonstration of the voice produced by the Prose 2000 call Telesensory's computer-controlled demonstration phone line at 415-856-0225... the computer will answer. The prose 2000 board will cost \$3500; the PR2020 peripheral costs \$4800.

Telesensory Speech Systems, 3408 Hillview Ave., Palo Alto, CA 94304. Reader Service number 468.

PSIO Board For Apple

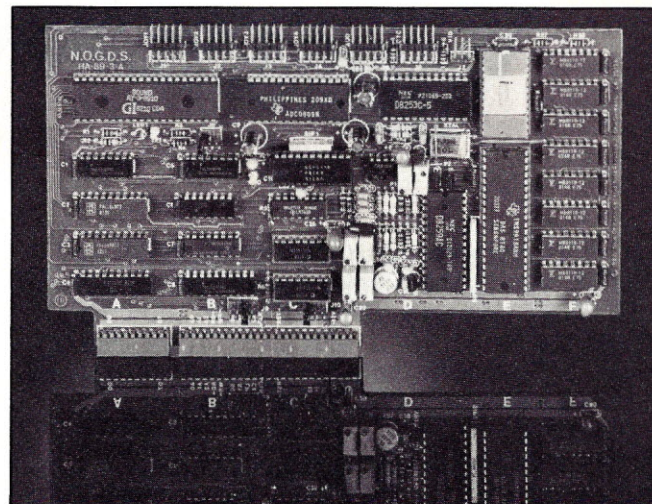
Intra's Programmable Serial I/O board is fully compatible with current Apple software including Pascal, Applesoft and Integer Basic. It

provides a full EIA RS-232 DTE interface to most modems, printers and monitors, as well as an opto-isolated current loop interface strappable for full or half duplex, active or passive, two-wire or four-wire, 20 mA or 60 mA operation up to 200 V. On-board 1K ROM software enables user-programmable printer width control, delay after carriage return, automatic line-feed generation and video display. Serial character format is user alterable with the most popular configurations set as default conditions. Prices start at \$199.95.

Intra Computer, 101 West 31st St., New York, NY 10001. Reader Service number 471.

H-89 Color Graphics

New Orleans General Data Services, Inc., 7230 Chadbourne Drive, New Orleans, LA 70126, offers a color graphics board for H-89/Z-90 computers. The board dis-



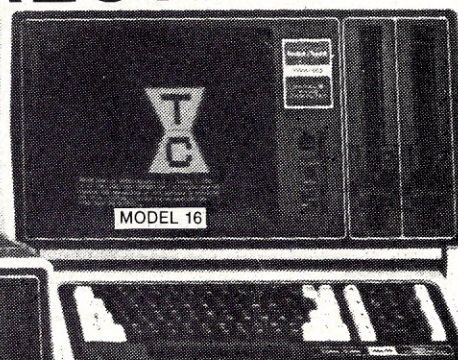
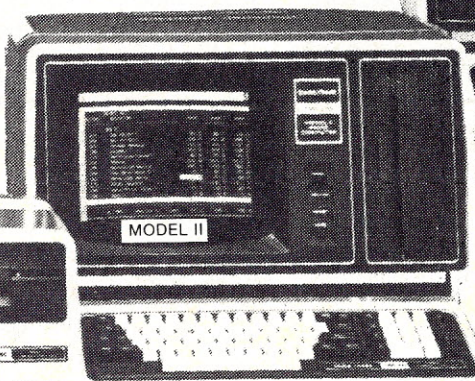
This H-89 color graphics board from New Orleans General Data Services also includes a sound generator, ADC and interrupt controller.

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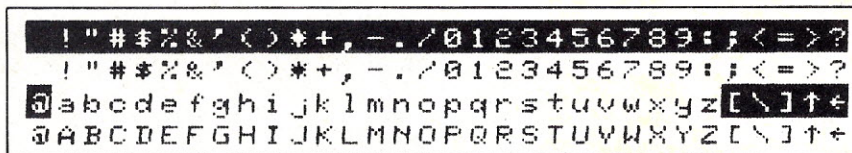
What is it?

The LCA-47 is a small PC board (1.9 x 3.6 in.) that plugs into your computer's main PC board: leaves the expansion connector free. It doesn't take up any system memory: uses a fast Bipolar Character Generator for guaranteed operation. Installation is quick and simple: no cutting or soldering required. Fully assembled, tested, and guaranteed for 1 full year.

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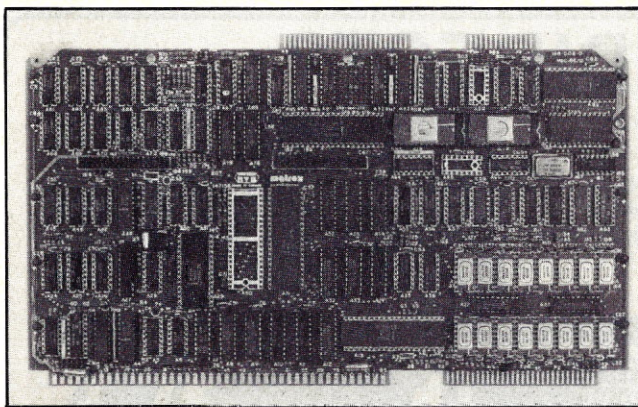
How to order: Send \$75.00 plus \$5.00 shipping in the U.S., \$10.00 elsewhere, to:

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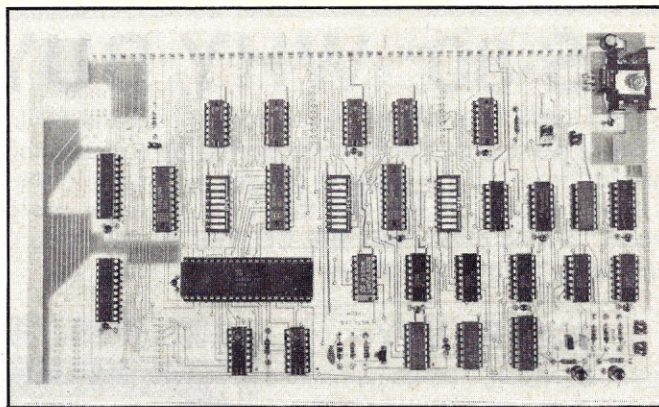
The Matrox MBC-86/12 Multibus CPU card.

plays 16 colors with a resolution of 192 by 256 dots, using the TMS-9918A Video Display Processor chip. Besides graphics, the board hosts a three-channel programmable sound generator, an analog-to-digital converter, a triple 16-bit counter/timer and a priority interrupt controller. Floating-point math, digital-to-analog conversion and Votrax speech synthesis are optional. The board plugs into one of the I/O slots, and has fully buffered address, data and control lines. It is compatible with

Pascal. The board costs \$399, with documentation and CP/M or HDOS software. Reader Service number 464.

Multibus Single Board Computer

The Matrox MBC-86/12 is an 8086-based 16-bit Multibus CPU card. It was designed as an enhanced equivalent to Intel's ISBC-86/12, and is fully software compatible. The Matrox board features a 5 or 8 MHz 8086 processor plus a socket for an on-board 8087



The Z809 Softboard from Meta Lab adds CP/M to 6809 systems.

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Matrox Electronic Systems, Ltd., 5800 Andover Ave., Montreal, Quebec, Canada H4T 1H4. Reader Service number 478.

slot—just boot the system with the included disk and you're up and running CP/M. Total system price is \$595.

Meta Lab, 2888 Bluff St., Suite 106, Box 1559, Boulder, CO 80306. Reader Service number 467.

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TNW Corp., Dept. NM, 3444 Hancock St., San Diego, CA 92110. Reader Service number 474.

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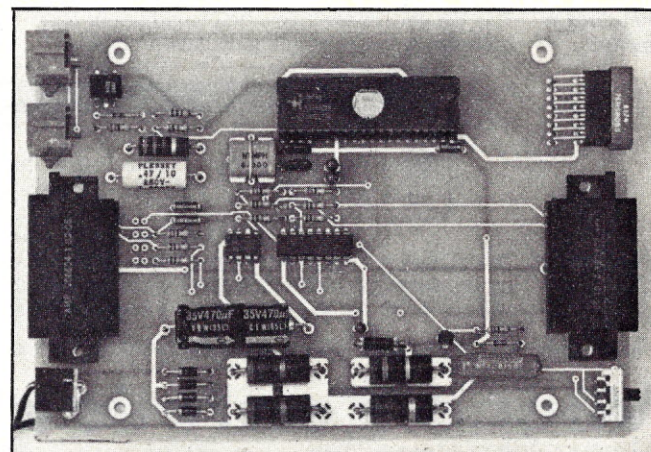


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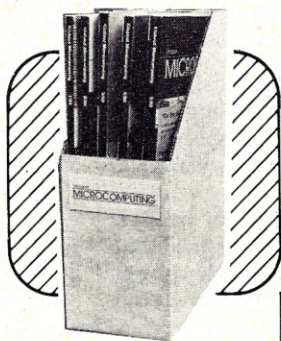
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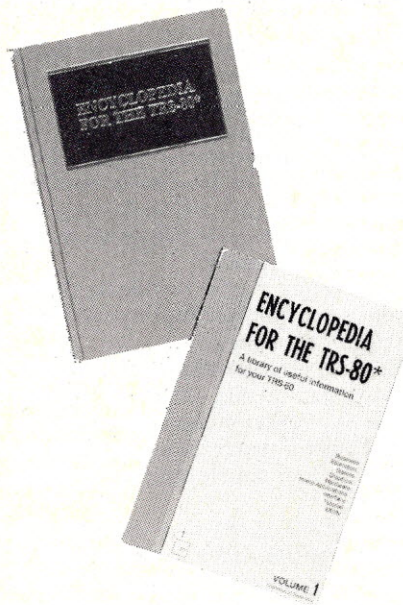
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SOFTWARE REVIEWS

(continued from p. 162)

ally there when you need it, and doesn't intrude when it would be a nuisance.

One of the nice things about the Apple II is the wide variety of interface cards and printers that can be used with it. One of the terrible things about the Apple II is that you can never be sure that your card and printer will work with a specific program, particularly when dealing with a tricky matter like high-resolution graphics.

Zoom Grafix, however, solves the problem. No patching or responses to technical questions are required.

Also, the same program does not have to be sold in a separate version for each printer. If you get a new printer, you don't have to toss out your old program. This is the way that software should be written.

(Phoenix Software, Inc., Lake Zurich, IL 60047)

**Barry Bayer
Homewood, IL**

Magic Typewriter

Not just another
Word processor,
Database manager

Magic Typewriter, which runs under North Star DOS or CP/M, was written to satisfy the needs of a professional author, and that is part of the reason it stands out from many other word processors.

Another reason is that it is also a database management program (without, however, mathematical abilities). It has versatile and fast sorting, searching and formatting functions, and can be used as a mailing list program.

All of the functions of Magic Typewriter are on-line at the same time; there is no separate program or module to load in order to use any of its functions, from word processing to sorting to database management. Nevertheless, the program occupies only 11K bytes of memory.

Since Magic Typewriter does not use special terminal commands, you can use it with any video terminal or monitor. The other side of this coin, however, is that the display and formatting are considerably more pedestrian than is the case with other word processors which require extensive configuration.

Word Processing Mode

Unlike several of the well-known word processors, Magic Typewriter is line-oriented rather than screen-oriented. It

uses line numbers, which it automatically generates, and any editing, other than global, requires you to specify the line number or number of lines you want to edit.

With Magic Typewriter what you see on the screen during text entry or editing is not what you get; that is, while you obviously get as the printed document the words you put in, they are not necessarily in the same location as where they appeared on the screen during text entry. To prepare an itemized bill or listings, charts, or tables of various types requires a few extra commands or extra attention to ensure that things line up and appear in their proper locations. Magic Typewriter does permit viewing the document on the screen in its formatted condition.

Magic Typewriter takes automatic page numbering a step beyond where most other word processors leave off. In addition to being able to specify on which line and where on the line the number is to be printed, the option is also given to print the number on the left on even-numbered pages and on the right on odd-numbered pages—just like in a printed book.

Likewise, Magic Typewriter provides for a running heading that can be printed at the top of each page, and also allows the use of a different heading for odd-numbered pages from that on even-numbered pages. Magic Typewriter even has a command for the printing of section-page numbers, in the form 3-1, 3-2, 3-3, 4-1, 4-2, etc.

Magic Typewriter has a "conditional eject" command, which I consider to be one of the signs of a well-designed word processor and quite a time-saver. This command allows you to cause the word processor to check whether a specified number of lines are left on the page before printing whatever follows the conditional eject command.

Underlining, right justification, left justification, full justification, and centering are all supported.

Magic Typewriter allows the use of embedded commands. That is, regular Magic Typewriter commands can be inserted into the text to cause, for example, a switch from double spacing to single spacing.

With Magic Typewriter you can pass various control codes to the printer to utilize its expanded functions by use of the PCOM command, either directly or as an embedded command. Not all word processors can do this, so if you have or may get an intelligent printer, this ability of Magic Typewriter is of importance.

However, Magic Typewriter is not perfect. For example, it does an automatic

form feed when it is told to print. Since you have to line the paper up in the proper place to begin with (or else the form feed will advance to the wrong spot), this feature is of no benefit that I can discern, but wastes one sheet of paper each time the printer is activated.

Also, every time control-C is used to exit from certain commands or modes, but to stay within Magic Typewriter, the bell rings.

Before directing the output to the printer, you must give the command "DLN" (Delete Line Numbers). Failure to do so causes the line numbers to be printed as part of the document.

As a database manager, Magic Typewriter creates files composed of "records" of any (and varying) length up to 199 characters. Records can be further subdivided into fields of varying length; the field delimiter is the semicolon. Unlike many database managers, records and fields need not contain a constant number of characters, with the result that memory and disk space are conserved.

Magic Typewriter has a number of formatting, masking, sorting and searching commands with which the database can be manipulated.

Viewed as a whole, Magic Typewriter is a well-conceived, efficient, apparently crash-proof, and smoothly running word processor and database manager. It has enough features and commands to satisfy demanding users, yet its basic features are simple enough that with minimal instruction even non-computerists can be doing an efficient job of word processing after only a few hours practice.

(California Digital Engineering, PO Box 526, Hollywood, CA 90028. \$175.)

**John Bryant
Holcomb, NY**

Newscript

A big-league
Word processor
For the TRS-80

I've seen an awful lot of software from an awful lot of people, and Newscript is one of the best products I have ever seen. Period. If you're looking for a TRS-80 word processor, you're short-changing yourself if you don't look at its impressive features.

First, you boot up. The Auto command on the diskette automatically loads and executes the machine-language component NS/CMD, which then loads in Basic, and the driver program. Here, you run either Edit or Script. Edit lets you enter the text. After you're done, you enter the word END on the Edit command line, and your text file is changed.

You're then asked if you want Script to process the file. If you enter Y, Script processes your text.

Newsprint's Editor

Newsprint's Editor is interesting: it's the only major word processor around written partly in Basic. Some people turn up their noses at this before trying out the system, which is unfair. Newsprint comes with a machine-language routine called NS and adds repeat key function and type-ahead capability.

Newsprint doesn't suffer much from the usual speed limitations of Basic. Once in a while it becomes apparent when Basic performs its garbage collection, but this doesn't happen often.

The 128-keystroke type-ahead feature is nice. Keystrokes will be stored when Newsprint is doing something else until Newsprint is free to execute them.

The editor is full-screen. The extreme left side of the screen is devoted to a LIMA (line manipulation) column. You can move the cursor here to mark a line to be copied, moved or deleted, or at the start of a block of lines to perform some function. You can label the line or insert blank lines after it.

The top line is a command line area, and when you want to enter a command you move the cursor up here and type in the command. The rest of the screen is the data area, where your text resides.

You can have lines longer than 60 characters, and can view any window of your text with ease. You can page forward or backward any number of pages at a time, or you can scroll horizontally and vertically.

To enter text, you type. If you press enter while typing a line, the line will be entered, and a new line will be inserted directly after the current line. To move the cursor to the start of the next line without creating a blank line, merely press shift and down arrow.

The clear key is the control key for Newsprint; you can insert or delete characters, clear to the end of the line, split a line at any spot or enter an up arrow character.

If you include the shift key, you can toggle the auto-repeat function, copy the screen to the printer, turn on dual routing (if on, everything that goes to the video also goes to the printer), toggle the Japanese character set (Model III only) or toggle the special characters and space compression (Model III only). Also, you can easily enter any two-byte hexadecimal code.

If the setup of the Edit program sounds vaguely like an IBM 70 terminal, it's because all the nice features of the terminal are included. In fact, while the IBM terminal does not have a repeating delete key, Edit provides one.

Edit has a command called Whoops (W) for recovering from an input error. It's limited in scope (you must invoke this command while the changes are still fresh on the screen), but it's a handy feature.

You can label lines for moving, copying

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DI09, Digital Interface with Timers—\$330

■ timing and interrupt capability ■ direct connection to BCD digits, switches, relays.

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All DAISI interfaces come complete with cable, instructional diskette and comprehensive manual.

or deleting blocks of text. You move the cursor into the LIMA area and enter .A, .B or .C.

Edit has about 40 commands available, although you usually need less than a dozen at once. File commands let you load files from disk in the middle of your text, kill files, get a directory (non-TRS-DOS operating systems) and invoke an Autosave function to save your text automatically every few lines.

Other commands let you know how much free space is available in your text buffer and the length of your document, route portions of your text to the printer and display or change the name of the text file in memory.

The most elaborate set of Edit commands are the change commands. You can find or locate words within defined zones of your document. You can alter, change, copy or delete text words. You can manipulate your document by joining lines or replacing strings with other strings, and this can be done throughout your document, or within user-defined zones of it.

The latest version (6.2) also allows for odd-even titles. This prints out one title at the top of the even-numbered pages and another at the top of odd-numbered ones. And it contains a rudimentary help feature if you need an answer to a question quickly.

The text processor, Script, knows what to process and how. Script control words are embedded in the document. Text words are preceded by a period and start a line. Thus ".ju off" is a recognizable control word to Script.

These control words are sprinkled throughout your document and provide a flexible way to format text.

Script—the Text Formatter

You can specify a number of run-time options to control Script. You can even edit your file as Script processes the text, or pause or cancel the printing at any time. You can also send the formatted text to the video only.

As mentioned, Script formats the text in response to the control words embedded in the text. You can toggle justification, centering, hanging indents and indentation; you can begin paragraphs, tell Script to go grab another file and stick it in at the current location; begin font; specify top and bottom titles and margins; double, single or triple space; control the size and darkness of specific words (and/or underline them); set a footnote margin; indicate a word to be indexed; set line length and page length and logo space; control page numbering; allow keyboard input to be entered into your text; space any number of lines (including half-lines); pause during execu-

tion; specify tabs; build a table of contents; and more.

You can produce excellent documents using only a few of these commands, and you still have the rest at your disposal. You can easily create form letters with customized headings from a mailing list, for example.

The ".RD n fileid" lets you read n lines from a disk file named Fileid. Thus, you may have a customized form letter sent to each person on a mailing list with the addition of a single command. I don't know of another word processor for the TRS-80 that lets this be done so easily.

I've spent many hours trying to make sense out of undecipherable, poorly-reproduced and unreferenced manuals. Newscript's is so good that I recommended it as a model. And since it was done entirely on Newscript it serves as convincing evidence of what can be done with Newscript.

The manual features excellent reproduction and organization, a complete table of contents, a thorough index, readable and understandable text and a folding quick-reference card. ■

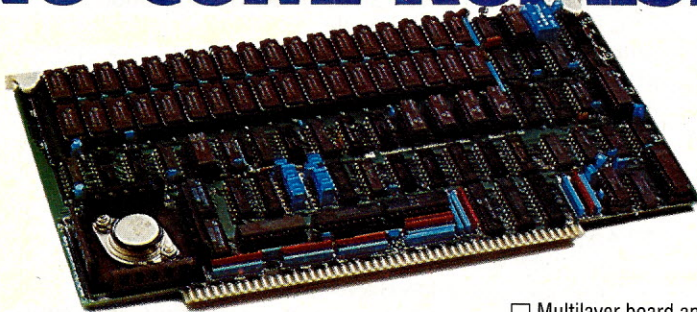
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Bruce P. Douglass
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Since this review was written, Prosoft released Newscript Version 7.0, which includes the following additional features:

- fast editor
- buffered printing
- reduction of string compression to 1.5 seconds maximum
- editing 300-375 lines at a time
- mnemonic-based control keys for faster, easier editing.
- more menus, automatic transition from edit to printing
- native support for serial printers, including 1200 bps operation on 45-55 cps printers
- support for conditional hyphens
- more natural use of the enter key (like a typewriter)
- uses TDOS 3.4 for more reliable, tolerant disk I/O
- partial recovery in edit after system failure
- certain printers can be paused in mid-line to change typing element
- run-time option to select page # placed on first page
- full formatting of variable text entered into Script from keyboard while document is printing
- "anti-widowing" to prevent last line of a paragraph from printing by itself at top of next page
- semi-automatic numbering of sub-paragraphs and points
- easily-used screen graphics touch-up while editing

- sorted, numbered directory (only with TDOS)
- selection of file to be edited or printed by number or name from menu
- revised, expanded, improved reference card

Release 7.0 costs \$124.95. For Release 6.0 or 6.1 owners, the update charge is \$35. \$25 for Release 6.2 owners.

Wizardry

The most comprehensive
Role-playing fantasy
You could dream of

Before sitting down at your Apple keyboard to play Wizardry, make sure you have a good supply of food and drink at hand, because you won't be going anywhere for a while and starvation can end a game prematurely.

Wizardry is an addictive game that is capable of consuming lots of time. It accommodates up to six players though, so the family can join in. All you need is a 48K Apple computer with one disk drive and DOS 3.3.

Wizardry appears to have elements of Adventure combined with a large help-

ing of Dungeons and Dragons and even a maze thrown in for good measure.

The game begins in a castle, but on the initial run characters will have to be created before the actual adventure begins. You generate characters according to skills, abilities, possessions, ethics—good, neutral, evil—and race—elf, halfling, dwarf, human and half-elf. All information about your character is kept on disk and, after a game or session is finished, it is returned and updated. You may thus continue with the same character over many sessions.

There are many permutations and combinations possible in generating the characters and assigning attributes to set up the initial party for the adventure.

Once the party has been formed and equipment purchased or traded for, it is time to leave the castle for the dungeon.

I won't go deeply into the actual game, so as not to spoil any surprises for you. A few points, however, will be made.

Mapping the dungeon is a good idea, so that you can find your way back to the exit.

In the maze, reciting the proper spell can extend your view and reveal hidden doors.

When returning to the castle with dead adventurers, the dead will be taken away by the guards and transported to the Temple. It is a good idea, therefore, to strip them of items and gold since, if the

character cannot be resurrected, the Temple will sacrifice all his possessions to the gods.

Wizardry is not just a maze game—monsters will be encountered from time to time. A message will alert you to the encounter and, in a few seconds, a graphic display of the monsters will appear. The types of monsters are many and varied and include the likes of Orcs, Zombies, Mummies, etc.

When the monsters are slain, there is sometimes treasure to be found, but there is also sometimes a slight hitch: the treasure may be in a chest which will have to be opened. And the chest just could be booby-trapped.

Magic items play an important role in Wizardry. Most of the important ones are found only in the dungeon, guarded by monsters.

In the event you exhaust all the possibilities in this scenario, others are available, and characters already in existence can be transported from one scenario to another.

This is probably the most comprehensive role-playing fantasy I have seen to date. If you're tired of Adventure, give this game a try.

(Sir-tech Software, Inc., 6 Main St., Ogdensburg, NY 13669.)

Ronald Bobo
St. Louis, MO

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Microcomputing, August 1982 155

DEC Software Professional Graphics Atari Gets Down to Business Zenith "Calc" Program Biblical Word Processor

Software for DEC Personal Computers

A comprehensive line of software programs for use on Digital Equipment Corp.'s personal computers is available from Saturn Systems, Inc., 6875 Washington Ave. S., #218, Minneapolis, MN 55435. Running under RT-11, the software provides word processing, spelling error detection, list processing and electronic calculator capabilities. All products use standard ASCII files. Reader Service number 485.

Full-featured Graphics

The Graphics Processing System (GPS) from Stone-ware, Inc., 50 Belvedere St., San Rafael, CA 94901, puts professional quality graphics on an Apple II. GPS creates, manipulates and edits

graphics much as a word processor does text. The program includes a grid that lets you work to scale. Six primary colors can be mixed. Two zoom features increase resolution.

The standard version of GPS works with any Apple-compatible paddles or joystick; price is \$59.95. The professional version is compatible with Apple Graphics Tablet, Symtec Light Pen and Houston Instruments HiPlot 3, 4, 6 and 7; price is \$99.95. Both versions speak directly to the Apple SilenType printer. Reader Service number 483.

Atari Cash Register

The microcomputer age comes to retail sales via C.R.I.S. (Cash Register Inventory System)—a complete software package that converts an Atari 400/800 into a point-of-sale terminal. The

C.R.I.S. program supports up to 1000 separate inventory items; information on back-order, total items sold, items in stock, stock ordered and vendor numbers are all instantly accessible. The activities of up to ten salespeople can be tracked, and a user-defined commission rate can be assigned to each. The system also prints complete inventory reports. Price is \$249.95. Adventure International, Dept. G, Box 3435, Longwood, FL 32750. Reader Service number 484.

Time Management

The Priorities package increases productivity for up to ten professionals or managers by focusing the user's attention on tasks scheduled for the day. It encourages improved allocation of time by requiring that tasks be assigned a priority and appointments be given a duration. Priorities runs on a 64K CP/M system with eight-inch drive. Price is \$99.50.

Big Island Computer Systems, Inc., PO Box 777, Pahala, HI 96777. Reader Service number 497.

Atari Games

Two new games for the Atari 400/800 computer have been introduced by EPYX, PO Box 4247, Mountain View, CA 94040. King Arthur's Heir casts the player as Arthur's right hand and heir to the throne of the Britons. To prove himself worthy, he must go in quest of the

treasured Scroll of Truth, hidden by the great wizard, Merlin. If the player uses his powers wisely, he will achieve his end. King Arthur's Heir is available on disk for \$29.95. Joystick controller is needed.

Alien Garden challenges the player to survive in a world inhabited by enticing crystal life forms. Some crystals are edible, others explosively deadly. Nine skill levels add to the challenge. Alien Garden is available on ROM cartridge for \$39.95. Reader Service number 498.

Spreadsheet for Heath/Zenith

A spreadsheet calculator tailored to Heath/Zenith computers and terminals is available from The Software Toolworks, 14478 Glorietta Drive, Sherman Oaks, CA 91243. ZenCalc is a tool for financial and numerical model building, forecasting and problem solving. Simple keystroke commands operate on entire rows or columns to rearrange data. ZenCalc comes with examples including templates which automatically compute the IRS 1040 and Schedule A. Price is \$99.95, on 5¼ or eight inch disks. Reader Service number 486.

Native Code Compiler

A new Basic compiler from System/Z, Inc., PO Box 11, Richton Park, IL 60471, promises greater versatility for programmers using CP/M



Architect Walter Hanson develops a kitchen design with the professional version of GPS, using the Apple Graphics Tablet.

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systems. Basic/Z has a library of over 200 keywords, a self-contained sort, advanced string handling and elective data filing strategies. As a native-code compiler, it offers the fastest possible execution speed through generation of executable machine code compatible with 8080, 8085 and Z-80 processors. To avoid fatal system disk errors, Basic/Z offers multitiered error trapping. The programmer can elect to use alpha-numerical labels in place of line numbers, for more flexible routines. All floating point math operations are performed in decimal to avoid conversion or round-off errors. Price is \$345. Reader Service number 487.

Adam, Eve and The Apple

The Word processor is a computerized version of the King James Bible, including the complete text and software for word processing and data management. The medium permits linguists, theologians or students to analyze biblical text in heretofore impractical detail. For example, you can scan the text for any combination of words to discover where and how often that combination occurs. You can keep libraries of indices referencing all verses relevant to a specific topic. Any verses or references of special interest can be printed on request. The Word processor package for the Apple computer consists of eight disks and a manual, and is priced at \$162.45.

Bible Research Systems, 8804 Wildridge Drive, Austin, TX 78759. Reader Service number 488.

Against the Wind

The Softpedal software and transducer pickup system converts any bike, from a Sears Exercycle to a Fuji superlightweight, into a computer-aided trainer. The Softpedal programs display a simulated race course on a video screen interfaced with a VIC-20 or Color Computer. The user can pace himself, race the clock or race a "com-

petitor." User input options add incentive. The Bike Race program displays average and current speed, elapsed time and distance—feedback aimed at helping the cyclist maintain constant speed. The Dashboard program presents an individualized goal of a set number and length of lap "legs," and average speed to maintain for each leg. Bar graphs display percentage completed and speed in miles per hour. The bicycle "dashboard" shows average speed per leg, distance covered and overall average speed.

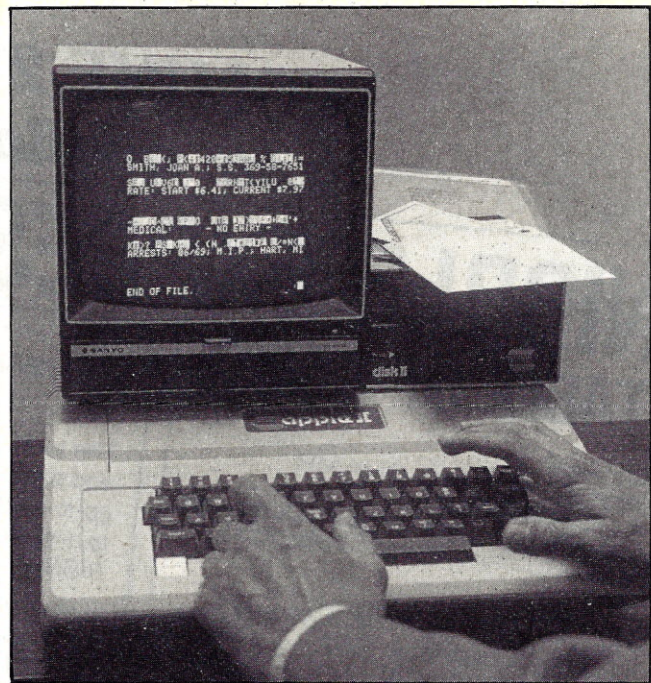
Softpedal is available from Practical Applications of California, PO Box 255768, Sacramento, CA 95825. Options include a stand with an integral wind load mechanism, which simulates actual road conditions at any speed. Softpedal price is \$145 with stand. Reader Service number 493.

CRT Emulator For Apple

A high-speed communications package for the Apple II computer has been announced by Softronic, Inc., 6626 Prince Edward Place, Memphis, TN 38119. Softerm allows an Apple system to emulate many of the popular CRT terminals used to access applications on large host computers and time-sharing systems. The software supports operation at a data transmission rate of 9600 baud, and lets you connect to the host computer directly or through a standard modem. Softerm costs \$150. Reader Service number 492.

Martian Gold Rush?

Klondike 2000 is a space adventure game that strives to capture the spirit, excitement and risk of a Gold Rush on Mars in the year 2000. Each player becomes a member of a team exploring the Martian desert. The team discovers a mine filled with gold, a mine abandoned during the Mars Colony Rebellion of '98. Team members become enemies as they compete to hoard gold found in the mine's caves. Robots who in-



The Classified program from Passage Research lets you quickly and easily encrypt your private files.

habit the caves guard the gold. Each player must befriend the robots by... well, you get the idea. Klondike 2000 runs on the Apple II; it costs \$29.95.

Hayden Book Company, Inc., 50 Essex St., Rochelle Park, NJ 07662. Reader Service number 494.

Joystick Graphics

Rainbow Graphics is for artists, youngsters, handicapped people, designers or anyone who wants to use an Apple to draw. A joystick with two push-buttons controls all functions, modes and drawing. Rainbow Graphics draws lines, dots, frames, circles, polygons and boxes on command. It has color fill, move area, clone area, a label function with six fonts and an edit detail feature. Full shape table functions are included. Routines are included to print pictures on a Silentype printer. The Rainbow Graphics disk costs \$29.95.

Rainbow Computing, 19517 Business Center Drive, Northridge, CA 91324. Reader Service number 495.

Data Encryption

Classified, from Passage Research, 945 Turquoise St., Suite G, San Diego, CA

92109, encrypts and decrypts the information stored in any standard Apple DOS 3.3 disk file. For the encryption algorithm, Classified duplicates the DES (Data Encryption Standard) enciphering computation in machine language code. The encryption key is entered from the keyboard as a nine-character combination of letters, numbers or symbols. The encryption manual supplied with Classified quickly shows you how to do it. Classified costs \$39.50. Reader Service number 489.

dBase Program Generator

A new program called dBgen translates prototype screens into dBase II command files. Users can lay out screens, reports and menus with a word processor, screen editor or the Modify Command feature in dBase II, and then convert them directly into dBase II application programs with dBgen. The entire process, including creation of the DBF database, takes less than two minutes, and the generated program can be run immediately without any intermediate steps.

The dBgen program produces dBase II command files that can be modified to suit a

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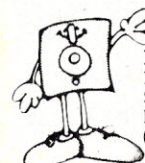
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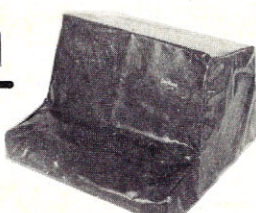
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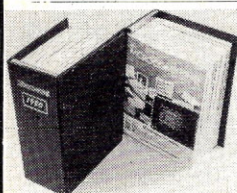
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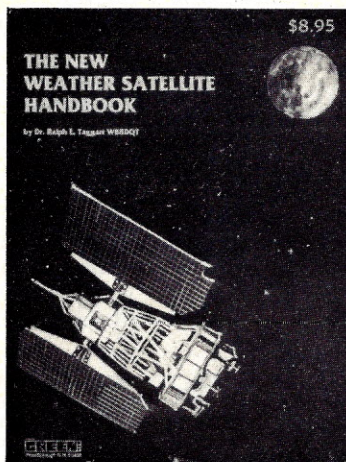
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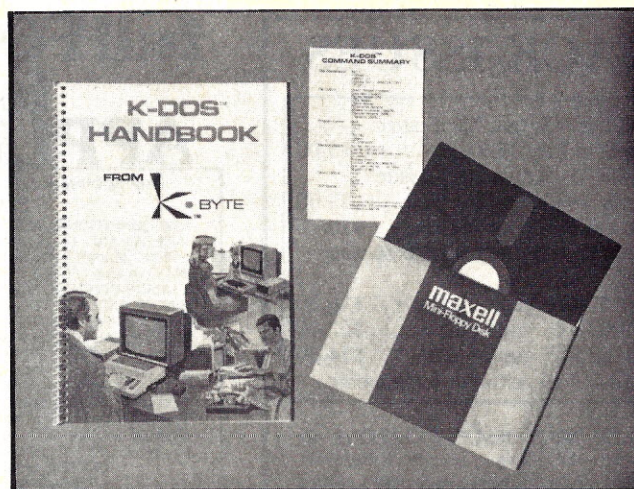
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A 40-page instruction handbook acquaints the Atari programmer with K-DOS features.

specific situation or run as is. The generated application is a complete menu-driven system, providing basic file maintenance procedures including add record, change record, display record and erase record.

It's available from Active Computer Enterprises, 1953 E. Apache Blvd., Tempe, AZ 85281. Price is \$195. Reader Service number 490.

Database Manager For Apple

Access is a database management package for Apple computers. The system uses IRAM (indexed random access method) filing to store records in entry order; an index derived from the first characters of a specified field lets the user retrieve any record in less than three seconds. The word-processor-style editor lets you insert and delete characters, with full cursor control over fields and pages of a record. Access is available through the Apple dealer network, or from Spider Software, 98 Avondale Road, South Croydon, Surrey CR2 6JB, England, for £199.95. Reader Service number 496.

Atari DOS Update

K-DOS is a more powerful and convenient DOS for the Atari 800, but is compatible with the Atari 2.0S and other related software. The K-DOS package supports the Atari 850 handler, which allows the

use of printers and modems.

K-DOS features a machine-language monitor for examination and alteration of memory in hexadecimal, and displays ATASCII representation; interception of the break instruction does not crash the system, but takes the user back into K-DOS. New commands reserve and erase memory and can be executed when the Basic or Assembler cartridge is in control. K-DOS lets you create your own commands. Price is \$89.95.

K-Byte, 1705 Austin, PO Box 456, Troy, MI 48099. Reader Service number 491.

Displaymaster

Master Computing, Inc., 11 Regency Hills Drive, Greenville, SC 29607, has introduced the first in a series of three software development utilities for CP/M systems. Displaymaster includes a display development utility (Displaydef) and user interface (Displayasm).

Displaydef lets the programmer easily and quickly define complex screen displays using the large system approach. The displays are saved as disk files and used by the application program through a series of directives contained in the Displayasm interface. The interface builds screen displays, processes data entries, handles messages and prompts, provides error checking and converts user entries into string, integer, single or double precision variables. Price is \$175. Reader Service number 482.

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North Star for sale—two double-density disk drives, 56K RAM and loads of the finest professional software (business and educational, plus games and utilities). With Hazeltime 1500 and cable. All for \$3650, including shipping, insurance and disk libraries. Evan Katz, P.O. Box 202, Greenville, NY 11548. 516-626-0004.

North Star Horizon—good base system. 32 K, two serial, one parallel in and one parallel out port, one dual density drive, Mullen S-100 extender. Mint condition, \$2250. Carl Cook, 2136 Evergreen, Garland, TX 75041. 214-271-0149 evenings.

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For sale: Apple II+ (rev. 4) with 48K RAM, new keyboard (auto repeat), new power supply, \$750; 1 yr. old Disk II with interface, \$260; without, \$230; Mountain clock, \$120; open frame 13-inch RGB monitor, \$250; thermal printer with interface, \$180; customized software also for sale. Will sell lot for \$1700, shipped COD. Ron Allison, Box 44032, Omaha, NE 68144.

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Amperdump

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Printers require special software driver routines, which sometimes have to be custom written—especially if they are to handle graphics. But the more popular computers now have a variety of driver routine packages available; and this is especially true for the Apple II.

One such package is Amperdump. It runs with your Apple II hooked up to an Epson MX-80 (with graphics modification) or MX-100 using one of four interface cards: an Epson parallel; an Orange Grappler; an Interactive Structures parallel; or a Mountain Computer card.

Amperdump was apparently originally developed to work with Madwest Software's "Ampergraph," a package of graphing and plotting routines. That package produced nice graphs, but only on the CRT screen or the Silentyte printer; there was no way to obtain document quality printouts.

Amperdump solves that problem, but it is not limited to graphics produced by Ampergraph. It can print anything in either page one or page two of the Apple's hi-res memory.

And Amperdump can print those pages either normally (black on white) or inversely (white on black); and it can modify the size of the printout (you choose one of three horizontal dimensions, and one of up to nine vertical dimensions, depending on which model printer you have).

Amperdump can be run from its own menu, or it can be called by an Applesoft Basic program. The commands are quite simple, and the user's manual explains them adequately.

The graphics are printed in anywhere

from 40 to 45 seconds to slightly over two minutes, depending on the size you select; this, however, is basically a limitation of the printer, not of the Amperdump package.

(Madwest Software, PO Box 9822, Madison, WI 53715. \$30)

Brownlee Elliott
Bloomfield Hills, MI

Zoom Grafix

No matter how smart,
Your printer needs
This Apple program

Zoom Grafix comes on a copy-protected 5 1/4 inch diskette with a seven-page manual. The first time you boot up the disk you are presented with the manufacturer's low-resolution logo. Eventually a configuration menu asks for the identity of your printer and interface card and whether you require line feeds, and the like.

After you enter the requested information, you are given the option of having the configuration stored on disk as a permanent setup. The computer saves the configuration, if requested, and moves to the main part of the program.

First, hi-res screen 1 is displayed, and you are asked if the displayed picture is the one you desire. If it isn't, the program offers to swap the displayed page with the contents of the second hi-res screen.

Actually, the contents of the screens are swapped back and forth, but Zoom Grafix is always looking at the first hi-res screen. If you don't want to swap, the program will permit you to enter the name of the file stored on disk, or you can hit return to get a Catalog.

Type in the name of the appropriate file, and that picture will replace the one on the screen. As a convenience in label-

ing picture files, "Pic," can be part of the file name either before or after the main identifier. Thus the file name Pic Monet, Monet.Pic and Monet may each be called by typing in Monet.

You can choose the following options from the main menu:

1. Specifies that the picture be printed positive (white on black) or negative (black on white).
2. Prints out the picture upright as shown on the screen or rotated to the right 90 degrees.
3. Specifies the ratio of printer dots to screen dots.
4. Selects a portion of the picture for printing and ignores the rest. As you select the print boundaries, the selected portion is outlined for you. But once you have made the selection of one of the four borders, you have to run through the entire (four-part) queue to change the setting.
5. Sets the left margin for printing.
6. Sets the maximum width available for printing.
7. Sets a delay after each line in .25-second intervals.
8. Changes the printer/interface configuration.
9. Generates a line feed or a form feed directly from the keyboard.

Zoom Grafix can be configured for 18 different printers and 21 different interface cards merely by picking them off of a menu in the configuration portion of the program. Configuration comes up automatically the first time you boot the disk.

If you save your setup to disk, you need never bother with configuration again, because the program will boot directly to the main menu. However, if you wish to reconfigure, ESC during the boot process. Using Option 8 of the main menu will lead you back to reconfiguration. In other words, configuration is automatic.

(continued on p. 152)

Thinking Multiprocessing?

Think Teletek's SBC-I

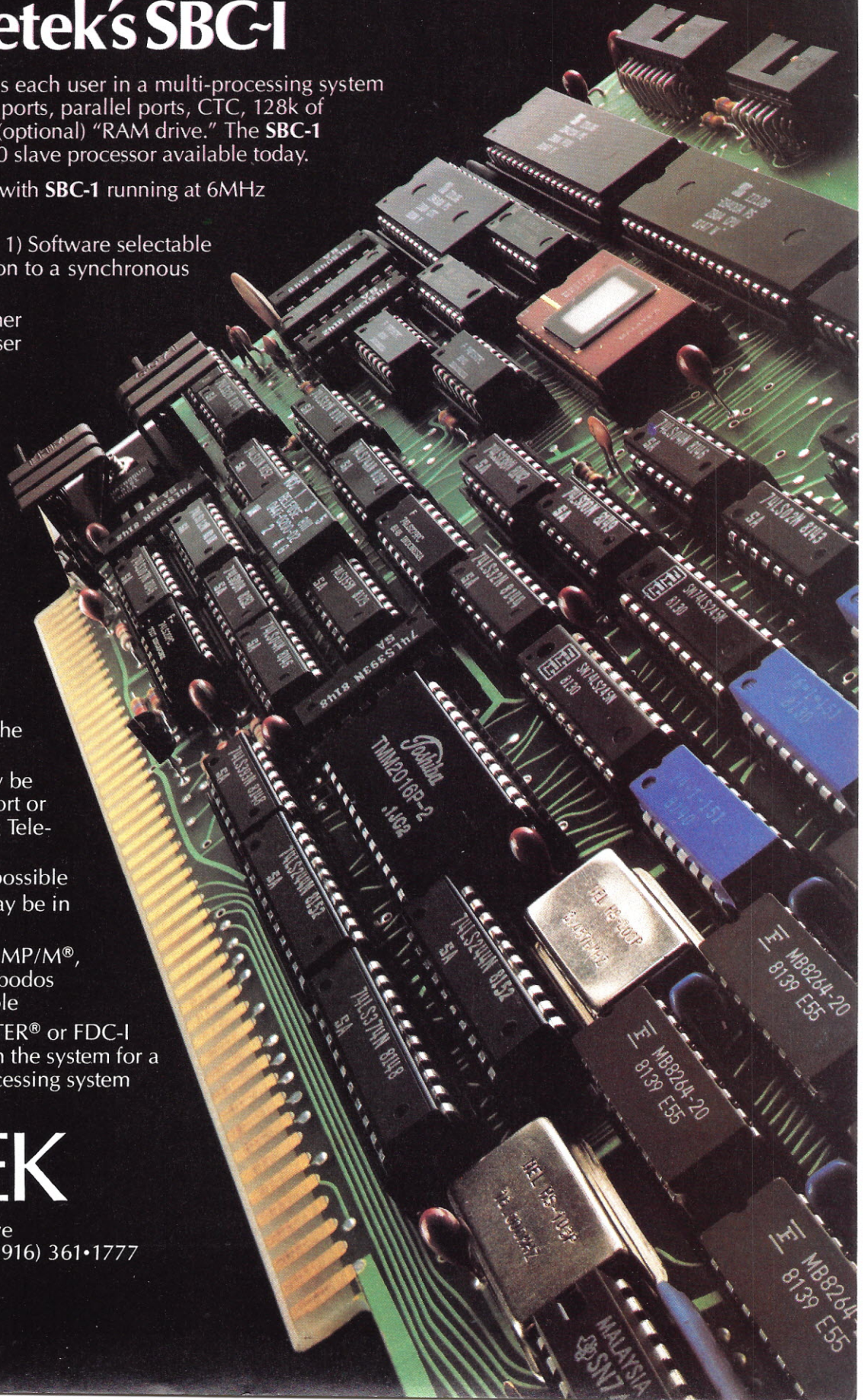
Teletek's **SBC-1** provides each user in a multi-processing system with his own CPU, serial ports, parallel ports, CTC, 128k of segmented memory with (optional) "RAM drive." The **SBC-1** is the most powerful S-100 slave processor available today.

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- Digital Research (CP/M®, MP/M®, CP/NET®), InfoSoft or Turbodos operating systems available

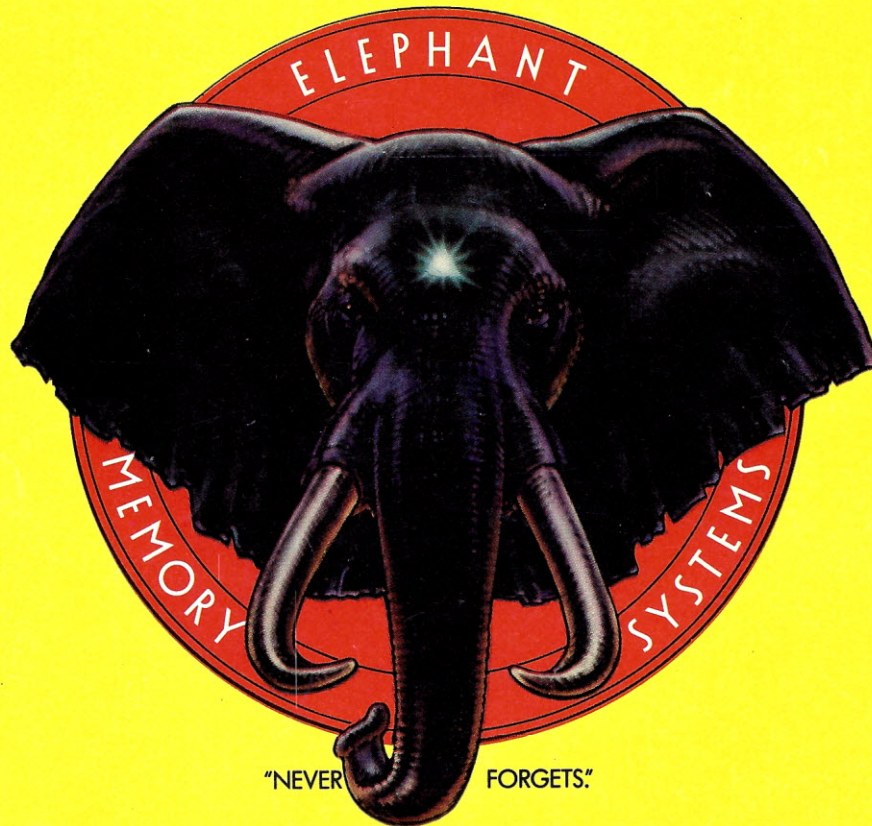
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